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FORESTRY ABSTRACTS

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FORESTRY ABSTRACTS

VOLUME 7 1945 NUMBER 1

FOREWORD

WITH this the first number of volume 7 of *Forestry Abstracts*, certain changes are made in composition and presentation, which, it is hoped, will facilitate the use of this journal: (1) It has been possible to revert to the larger type that was in use up to the end of volume 3. (2) Subject, species and geographical indexes are issued for volume 6 in addition to the authors' index which has been made available for each of the first five volumes. (3) Individual abstracts are numbered, the number being given in square brackets at the end of the title of each paper; numbers will run consecutively throughout the volume. (4) The section previously entitled 'Notes from the Daily and the Non-Technical Press' and now headed 'Forestry the World Over' has been somewhat expanded and it is hoped, as communication becomes easier, to include up-to-date forestry news from a wide range of sources.

At present *Forestry Abstracts* attempts to cover all forestry and allied subjects, and it is believed that the journal would serve its purpose more efficiently if published in two parts, one dealing with forestry proper and one with wood utilization and technology. A start has been made in this direction, and it is hoped that before long the proposed change can be undertaken, thus making available a more comprehensive abstracting service for each of these two broad divisions of forestry.

Apart from *Forestry Abstracts*, this Bureau publishes two series of occasional bulletins, *Technical Communications* and *Joint Publications*—the latter prepared in collaboration with other Bureaux. In order to make these publications more widely known they are being advertised in a number of forestry and agricultural journals throughout the Empire and in other countries. In addition, notices of publications are issued individually (e.g. enclosed leaflets) and collectively with those of other I.A.B. publications under the title 'Recent and Forthcoming Publications on Agriculture and Forestry'. Anyone who wishes to be notified of future publications of this Bureau, or of the I.A.B. generally, should send his name and address to:—Imperial Agricultural Bureaux, Central Sales Branch, Penglais, Aberystwyth.

PAPER-MAKING MATERIALS OF THE BRITISH EMPIRE[1]

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THE WORLD POSITION OF PULP PRODUCTION.

The countries of the British Empire contain vast stores of paper-making materials of all kinds, or possess potentialities for their cultivation. The utilization of these materials for commercial purposes is, however, a matter that is governed by several factors, economic and technical, which will be discussed more fully later, but the net result of all those considerations may be summed up in the statement that coniferous woods at the present time are the chief paper-making material of the world. In fact, about 90 per cent. of the paper produced is made from wood, the bulk of which is coniferous, while the amount of hardwoods used is only a few per cent. The remaining materials employed are rags, esparto grass, straw, bamboo, sabai grass, old ropes, fibres and waste paper. Any material which is brought under consideration as a major source of paper pulp is measured against the yard stick of the softwood pulp industries.

[1] Reproduced, somewhat shortened, from *Bull. Imp. Inst., Lond.* 42, 1944 (232–50).

Technically, coniferous wood is the material *par excellence* for paper-making on account of the unique stability of its fibres in length and other properties. It responds to different pulping processes and different methods of treatment in manufacture, yielding products as diverse in character as blottings and greaseproofs, newsprint and high-class bonds, tissues and krafts. No other material approaches it in these respects.

In order to understand the markets of the world in which Empire materials have to compete, it is necessary to glance at the existing position as regards production and consumption.

The key to the position being the coniferous woods, we must look for the countries possessing resources of these woods. These countries have a share of the northern forest coniferous belt. In the Southern Hemisphere there is no coniferous belt to correspond to that in the north.

From this picture emerges the fact that North America, Scandinavia and Russia with their wealth of conifers, possess a great advantage over other countries. The next point to consider is availability. Russia's forests are, to a large extent, remote from transport facilities, and at present her productive areas are required to supply her own needs. Scandinavia and North America with extensive waterways and abundant cheap water power, however, represent the sources to-day of the bulk of the world's paper and paper products.

The following table shows the total production of wood pulp in various countries.

WORLD PRODUCTION OF WOOD PULP
(Thousands of long tons.)

	1930	1932	1934	1936	1937	1938
United States	4,134	3,357	3,961	5,103	5,869	5,298
Canada	3,232	2,378	3,247	4,005	4,591	3,275
Sweden	2,409	1,965	2,824	3,105	3,468	3,013
Germany	2,055	1,682	1,979	2,330	2,524	2,504
Finland	1,059	1,243	1,543	1,945	2,097	2,077
Norway	917	886	967	976	1,080	893
Japan (including Korea and Sakhalin)	636	564	705	773	824	(*a*)
U.S.S.R.	378	429	517	689	728	(*a*)
France	143	182	276	337	349	337
Austria	312	279	314	331	407	377
Newfoundland	257	235	274	282	315	238
Czechoslovakia	308	285	320	282	367	(*a*)
Poland	106	92	121	142	171	184
Italy	130	123	111	137	181	183
United Kingdom	101	91	108	115	120	115
Netherlands (*b*)	91	95	99	106	119	103
Estonia	73	75	85	88	85	90
Switzerland	76	65	76	71	89	74
Lithuania	55	39	55	58	65	(*a*)
Roumania	42	31	45	50	56	81
Latvia	24	15	23	32	35	40
Other Countries	93	98	114	104	74	(*a*)
Total	16,631	14,209	17,764	21,061	23,614	(*c*) 18,882

(*a*) Not available. (*b*) Includes straw pulp. (*c*) Incomplete.

OUTLOOK FOR NEW MATERIALS.

Having seen the outstanding value of softwoods for paper-making, and the position of the countries possessing those resources, let us consider the question of introducing new materials from Empire or other sources to the United Kingdom. It is at once clear that this market is dominated by a ready supply of suitable pulps from a source close at hand, Scandinavia, and any material which comes under consideration for import into the United Kingdom will have to compete in technical properties, cost of production and cost of transport with the Scandinavian pulps.

The present position is that apart from esparto grass and very small amounts of fibrous materials,

required for their special characteristics, and amounting in all to a small fraction of our import, there is no material which has been able to contest the situation.

Newsprint is imported from Canada and Newfoundland, where it is produced under exceptionally favourable conditions.

Canada and Newfoundland are the only two Empire countries which have yet established an export of pulp or paper made from local material.

Although the outlook for placing new Empire materials on the United Kingdom market is unfavourable, except perhaps for the production of speciality papers, there is, however, a very important field of development for the paper-making materials occurring in Empire countries, namely, in supplying the local demand for paper, where, as in the case of the Dominions, this demand is sufficiently large to warrant the establishment of local mills. This would be followed by an export trade if conditions permit. In this connection we shall see that India has led the way, and Australia has recently made exceptional strides.

THE PRESENT POSITION OF PULP PRODUCTION IN EMPIRE COUNTRIES.

The position we will consider is that of 1938, with reference, where necessary, to subsequent permanent modification, but generally ignoring the abnormal conditions of the recent war years, for which, furthermore, full details, in many instances, are not available, or are withheld for security reasons.

We commence with the most important producer, and that is Canada, whose pulp production is the second largest in the world, while in newsprint output she occupies the premier position. In the Empire no other country apart from Newfoundland approaches Canada in importance as a source of paper pulp.

Canada.—The production of pulp and paper constitutes a major industry in the Dominion. It occupies first place among Canadian manufacturing industries. The great expansion in the Canadian industry has mainly followed the great increase in the world demand for newsprint during the present century, and particularly since 1920. The Canadian production of wood pulp is only exceeded by that of the United States, but the production of newsprint in Canada is nearly three times that of the United States, which was previously the world's largest producer.

The wood pulp production is about three to four million tons, manufactured chiefly from the soft (coniferous) woods, Spruce and Balsam Fir, with lesser quantities of Hemlock, Jack Pine, Poplar and other species, by mills, most of which are situated in Eastern Canada, principally in Quebec and Ontario, and also in British Columbia, Nova Scotia, New Brunswick and Manitoba. In 1938 there were 75 mills producing pulp. Of these 48 also made paper. In addition, there were 24 mills making only paper. The industry is mainly a newsprint production, about 80 per cent. of which in 1938 was bought by the United States, the world's largest newsprint consumer.

In 1938, 67 per cent. of the wood pulp produced was by the mechanical process, and 24 per cent. was sulphite pulp.

Canada's high place in the world's paper industry is, of course, due to her share of the earth's northern belt of softwood forests, combined with the existence of excellent and extensive sources of water power, and facilities for water transport. The harnessed hydro power is over eight million horse-power, equivalent to 40 million tons of coal per annum. The striking advantage of this national asset is easily recognized.

The annual withdrawal and loss to the forests is about 4,000 million cu. ft. of timber a year, of which 800 million is the present rate of absorption for the wood pulp industry, while the productive stand is about 170,000 million cu. ft.

It has been alleged that Canadian forests have been despoiled for the profit of newsprint concerns, and in the past, no doubt, prodigal use was made of the seemingly inexhaustible resources, but to-day the Dominion is aware of the value of re-afforestation to maintain her resources of constructional timber and pulpwood. A complete picture of the situation is difficult to obtain, but allowing for increases in the demand for building timber as well as for pulpwood, it is considered that a constructive forest policy has plenty of time in which to balance annual depletion with annual growth, if this is not already the case, before serious inroads are made on the capital.

Newfoundland.—This country possesses large forests of Spruce and Balsam Fir, which provide the

raw material for her staple industry, paper-making. In 1938 there were only two mills operating, producing 282,000 tons of newsprint, which was exported entirely to the United Kingdom and the United States, with the exception of a thousand tons to India. This export of paper was worth £2,669,000 and represents about 40 per cent. of the total exports.

There is no export of wood pulp, but pulpwood is exported, the quantity in 1938 being 60,000 cords, valued at about £130,000.

There are now three mills operating respectively at Grand Falls, Bishops Falls and Corner Brook, producing newsprint, sulphite pulp and baled ground wood, while a fourth mill, with a capacity of 100 tons a day, makes sulphite pulp.

India.—The paper industry of India has been long established, the first mill commencing operation as early as 1825. In 1870 the first mill of importance started production. This was followed at intervals by other mills, and by 1900 the paper produced in India amounted approximately to 20,000 tons. In 1925 there were nine mills in production. Up to this time the staple indigenous raw material for pulp production was sabai grass (*Ischaemum angustifolium*), common in Northern and Central India. Although India has a large population the paper demand is relatively small. Nevertheless the country's requirements represent a fair-sized industry, and in order to increase the production of home-made pulp it was necessary to look for other material than sabai grass, the supplies of which were limited and not capable of further expansion. Through the outstanding work of Raitt, bamboo was shown to be a suitable material to meet the local demand in many respects. A protective tariff, imposed in 1925, on imported paper which competed with Indian-made sorts, greatly assisted the paper industry and enabled bamboo pulp to be developed as the main local material. A further tariff in 1932 on imported wood pulp had the effect of countering the increased use of this material. The mills then began to increase the production of bamboo pulp, which had already established itself as suitable for writing, printing, bank, ledger and other classes of paper. Sabai grass is retained for some classes of paper, and is the chief material employed in the United Provinces and the Punjab, where adequate supplies of bamboo are not available. Otherwise bamboo is the main indigenous material employed. In the years from 1925 to 1931 the average annual production of bamboo pulp was about 2,000 tons, grass pulp about 10,000 tons, imported wood pulp 17,000 tons. By 1939 the production of bamboo pulp had risen to about 33,000 tons, sabai grass pulp amounted to 22,000 tons, while the imported wood pulp had fallen to approximately 13,000 tons.

There were in 1939 some 12 paper mills operating in India, producing 73,000 tons of paper, as compared with 27,000 tons in 1925.

Recently it has been shown that kraft pulp can be made from bamboo, and production on a commercial scale has commenced.

Attention has been given to materials for mechanical pulp. Projects for the establishment of newsprint mills in Kashmir and Tehri-Gahrwal States, employing local Fir and Spruce, are under consideration.

India imported prior to the war about 35,000 tons of newsprint, some 25,000 tons of paper board, and about 40,000 tons of other kinds of paper.

Australia.—The paper manufacturing industry of the Commonwealth is well established, but until recently it operated entirely on imported pulps, from which were produced approximately 72,000 tons of paper and board, valued at £1,500,000 per annum. Since 1938 rapid strides have been made in the supply of pulp from home-grown materials, and several imported pulp mills have come into being. For many years the Australian paper industry in co-operation with the Council for Scientific and Industrial Research has been investigating local materials, particularly Eucalyptus woods, as sources of paper pulp. The utilization of these woods presented problems which have necessitated modification of the usual pulping processes, and the important developments which have now taken place are the outcome of sustained effort over a period of some 20 years.

The mills making pulp which are now operating are as follows:

A large pulp and paper mill at Burnie in Northern Tasmania using the local Eucalyptus woods (*Eucalyptus gigantea*, *E. viminalis* and *E. amygdalina*) to produce a wider range of printing and writing papers. The process employed for pulping is a modified soda method. The project was at first to produce 20,000 tons of paper a year, and then gradually to increase its capacity. Pulp production commenced in 1939, and by 1942 the mill was turning out printing and writing papers

at the rate of 21,500 tons a year, of which 90 per cent. was Eucalypt pulp, the remainder being imported sulphite pulp.

At Boyer, 20 miles from Hobart, is a mill of outstanding interest, since it produces newsprint from local Eucalyptus wood, chiefly swamp gum, *Eucalyptus regnans*, and is the first commercial plant to manufacture mechanical pulp from hard wood. The furnish consists of 83 per cent. Eucalypt mechanical pulp, and 17 per cent. imported sulphite pulp. The present installation was designed to produce 27,000 tons of newsprint a year, but a second unit is contemplated to double the output, and ultimately it is hoped to increase production capacity to 108,000 tons.

A mill at Maryvale, Victoria, commenced production in 1939, after a pilot mill had functioned since the previous year. The mill produces kraft pulp mainly from Eucalyptus wood, and to a smaller degree from Pine, provided, according to agreement, from Victorian forests by the Forests Commission. The output of pulp is now about 30,000 tons a year, and is converted into wrappings and boards of various types. The company concerned is also working up waste paper and rags in addition to continuing on an increased scale its old-established production of strawboard.

Production commenced in 1942 at a new mill near Millicent, South Australia, of cardboard from waste paper, but the factory is designed to convert pulpwood thinnings, supplied on contract by the government from the neighbouring forests of Mount Barr and Penola, into kraft pulp and boards of various types. The wood is from the very extensive plantations of *Pinus insignis* which have been established. It is estimated that these plantations should be capable of yielding about 50,000 tons of wood a year which would be suitable for pulping. The production of boards in 1942 was at the rate of 5,000 tons a year.

Another mill is situated at Raymond Terrace, New South Wales, for the production of wood pulp, of which details are not available.

With regard to the size of the Australian market, before the war the normal consumption was 55,000 tons of writing and printing papers, while the newsprint requirements were 150,000 tons.

New Zealand.—At present there is only one mill in New Zealand manufacturing paper pulp, and that is the mill at Whakatane in the Bay of Plenty. This mill is producing mechanical wood pulp, mainly, it is understood, from the locally-grown conifer, *Pinus insignis*. The ground wood pulp is employed for the manufacture of paper board. The output of pulp at this mill in 1939 was approximately 10,000 tons, but it is understood that the yearly quantity is capable of being increased. A second mill at Mataura in the South Island has been making paper from rags and imported pulp for many years, but is not a producer of pulp.

A third mill, at Penrose in Auckland Province, designed to use the sulphite process for converting *Pinus insignis* wood into pulp, is understood to have started the production of a wall board.

In 1938 New Zealand imported newsprint to the value of £527,000, and paper, cardboard, etc., valued at £1,540,800. In addition to this, wood pulp was imported. The normal peace-time requirement of New Zealand in pulp of all sorts is of the order of 100,000 tons.

Union of South Africa.—The first mill in the Union for the manufacture of pulp was erected in 1938, at Geduld on the East Rand, Transvaal. The establishment is on an extensive scale, and is of considerable interest and importance from the point of view of South African enterprise, and from the fact that the Pomilio soda-chlorine process is employed, a process which has been introduced in recent years. The raw materials employed are wheat straw, the wood of *Pinus patula*, and Wattle wood (*Acacia* spp.), and the finished products are writing and printing papers, and specialized board. The present production is approximately 14,000 tons of paper and 2,000 tons of board per annum, but plans for considerably increasing the output are well advanced.

Although the Geduld Mill is the first, and so far the only, South African plant to make pulp, a mill has operated since 1920 at Klip River, Transvaal, producing kraft papers and industrial wrappings from imported wood pulp and local waste paper.

There is also a mill at Durban making carton, box and other types of industrial boards from waste paper and imported pulp.

Further mills have been under consideration to utilize thinnings from the *Pinus patula* plantations, Eastern Transvaal, and *P. pinaster* plantations, Cape Province, but the projects have not yet come into being.

With regard to the Union's requirements, an idea may be gained of the consumption of paper from

the following import figures for 1937. In that year the Union imported 42,000 tons of newsprint, 34,000 tons of other printing papers, and 37,000 tons of wrapping paper, in addition to which large quantities of paper board and other paper products were imported.

The United Kingdom.—This country has no softwood forests or other sources of material to compete with the Scandinavian and North American conifer stands. Consequently for our large requirements in paper we import about 1,600,000 tons of wood pulp, almost entirely from Scandinavia, only 1 per cent. being obtained from Canada and Newfoundland. The pulp made in the United Kingdom is from imported pulpwood, esparto, straw, rags and manila and other fibres. Since imported wood pulp constitutes 90 per cent. of the raw material used for paper, it will be seen that the quantities of the other materials employed are relatively small.

There are three mills in this country making pulp from imported wood, one by the mechanical process and two by the sulphite method. Esparto pulp is made on a fairly large scale, about 300,000 tons of the grass being imported annually. This is a relatively easy material to convert into pulp, which is required chiefly in the furnish of book and other printing paper, providing bulkiness and other desirable properties.

In addition to the 2,000,000 tons of paper and board manufactured in the home mills, the United Kingdom still needs further large quantities to satisfy her enormous demands. To this end approximately a further 1,000,000 tons are imported, the chief item being about 500,000 tons of newsprint from Canada and Newfoundland.

The above description represents conditions in peace time just prior to the war, when overseas supplies were unhindered. By force of circumstance paper makers have had to look more and more to home-produced materials in these last few years, and with normal conditions entirely disrupted, home-grown straw has become the chief material, apart from waste paper, for our paper production.

New Materials and Development of Empire Pulp Production.

We will now consider the possibilities of expansion of the existing industries and the utilization of new materials occurring in the Empire.

In the first place, let us look at the probable position of the producing countries in the future.

There is every reason to expect that Scandinavia, where efficient re-afforestation schemes ensure the equilibrium between cutting and reproduction, will be able to continue more or less indefinitely the pre-war rate of supply to the United Kingdom. The Canadian industry is, however, capable of further expansion. Although shortage of paper-making materials is a fear that perennially seizes the paper world, no real grounds for such an attitude with regard to the near future have been established. Nevertheless, it is sound policy to be prepared and the possibilities of new and alternative materials for consumption in the United Kingdom should be considered, on economic and political grounds.

Whether or not the profitable marketing of a new material in the United Kingdom can be accomplished, there is, as already stated, a clear road for development in overseas countries which are placed at a long distance from Scandinavia or North America, or the paper mills of the United Kingdom.

We can therefore decide that the utilization of new materials for pulp making should be considered throughout the Empire, in the first place for local use, and secondly, where conditions are favourable, for export to a suitable market.

In India, Australia, South Africa, and New Zealand the local demand for paper and paper board is large enough to maintain a home industry, but in the Colonies generally production of pulp for export is the only possibility.

There are many factors to be taken into account in considering the establishment of a new paper pulp industry, and these should receive the closest examination before a decision is made. Any material to be of value for pulp making must be available in large quantities. The smallest mill which, in most circumstances, it would be profitable to erect must have an output capacity of the order of at least 10,000 tons of pulp a year, for which would be required some 25,000 tons of raw material. The cost of collecting the material and transporting it to the mill must be sufficiently low. It must also be definitely established that the supply of the raw material in the requisite quantity can be maintained for a sufficient number of years ahead, to make the enterprise profitable. If these

conditions can be fulfilled and laboratory investigation has shown the material to be promising, then large-scale trials should be proceeded with. Yields must be determined, and the most suitable method of pulping worked out. If pulp of suitable quality can be produced, and the cost of production is known, then it remains to ascertain if the price will enable the product to compete successfully on the nearest overseas market or further afield. If the home demands and industrial conditions are suitable for the local production of paper or paper board, the cost of the pulp delivered at the paper mill as compared with that of imported pulp will be the deciding factor.

A pulp mill to be successful must be conveniently situated in regard to the availability of supplies of chemicals and of fuel or electric power, and, in particular, a good water supply must be available, since water in large quantity is essential in the manufacturing process.

Export of the raw material itself, although possible, would probably be ruled out by high freight, unless a consuming country were situated close at hand.

The new materials to be considered for utilization fall into three groups: (1) woods; (2) bamboos, grasses and reeds; (3) miscellaneous materials.

Woods.—With regard to woods, as we have seen, wherever forests of softwood, in sufficient quantity, and in suitable positions, occur, the establishment of a wood pulp industry presents no problem. Apart from North America, the British Empire contains no area of natural softwood forests sufficiently large to support a pulping industry. But there are stands of hardwood trees and of resinous trees in Empire countries extensive enough for commercial development, and to these materials attention of late years has been directed, not only in the lands of the Empire, but in the United States, and in Germany in particular.

The hardwoods, Poplar and Aspen, have been used in the United States for many years to a small extent, providing pulp of inferior strength, made by the soda process. This has been employed for a filler and for its property of imparting opacity and bulkiness to the paper. Whereas the fibre length of softwoods is about 3 mm., that of hardwood fibres is only half that figure.

Another disadvantage attending hardwoods is the fact that, while the conifers may occur in relatively pure stands, the hardwood trees generally occur in very mixed forests, and in considering their utilization the number of species concerned, per acre of forest, and the trouble of removal, must be taken into account. Large areas entailing ever-increasing haulage distances might be required to provide the tonnage necessary for the economic running of the mill, and might render the cost of collection prohibitive.

Another advantage which Spruce possesses is the uniform character of the wood throughout the trunk and of the spring and summer growths, a property shared also by Balsam Fir and the two Canadian Hemlocks, while in broadleaved trees the material from different situations in the trunk varies in density and character from the paper-making point of view, and some of the Pines show seasonal variation.

The pulp manufacturer requires a supply of uniform raw material because the digestion process which he employs will be worked out in detail to suit a given material. If the material varies beyond certain limits, which are fairly narrow, the digestion conditions may be insufficient or too drastic, giving defective pulp on the one hand or loss of yield and waste on the other. It is, therefore, seldom found that the wood from different trees can be cooked together, and the question of separating the kinds in felling, transport, and treatment at the mill will have to be considered.

In spite of these drawbacks, great progress has been made in the employment of hardwoods and resinous woods for paper production. In America, where hardwood species dominate the forests of the South, New England and the Lake States, Birch, Beech, Maple, Chestnut, Cottonwood and Gum have in recent years been used in addition to Aspen and Poplar. In Germany the use of Beech has been developed, more especially for rayon and staple fibre industries.

The relatively low cost of hardwoods, on account of their higher density, makes their use attractive, and in the case of mechanical pulp this offsets the greater power consumption on grinding.

The utilization of Pine wood, of which the world contains large forests, has appealed for notice, and the problem here is to overcome the objectionable content of resin. For this purpose the soda or sulphate processes with their alkaline action have been necessary, kraft pulps being produced. In recent years the sulphite process has been modified in its application to Jack Pine, and this resinous wood is now employed for sulphite pulp in America and Canada, so far on a small scale.

These resinous Pine woods have also been used in making mechanical pulp, but so far only on a limited scale commercially.

Although Canada is a land of plenty in respect of Spruce forests, nevertheless there are vast forests of Birch and Maple in Eastern Canada, and hardwood utilization is therefore of interest to the Dominion, if not to-day, perhaps to-morrow.

In Australia we have already seen that the commercial production of mechanical pulp from a hardwood, a Eucalyptus tree, has been achieved, and Eucalypts and *Pinus insignis* have been pulped by an alkaline process.

In New Zealand *Pinus insignis* is being used for the production of mechanical pulp, and is to be used for sulphite pulp, but New Zealand has other woods which have been shown to be suitable for paper-making. Some fifteen different home-grown woods were investigated in the years following the last war with a view to the utilization of waste wood from the timber industry. Part of this work was carried out at the Imperial Institute, the following eight timbers being examined: four species of *Nothofagus* (Beech), *Pinus laricio* and *P. insignis*, *Weinmannia racemosa* and *Beilschmiedia tawa* (Tawa). All these woods proved capable of yielding paper pulp of satisfactory quality. Work carried out at the Forest Products Laboratory, Wisconsin, with six New Zealand woods, showed, amongst other things, that a high-grade newsprint could be made with Insignis Pine sulphite and Tawa sulphite and ground wood.

In South Africa thinnings in sufficient quantity are available from plantations of Pine established primarily for timber supplies. Work at the Imperial Institute and in South Africa has shown that *Pinus patula* and *P. pinaster* are suitable for pulp production.

Another tree, *Eucalyptus saligna*, has been extensively planted in recent years in the Transvaal and Zululand for the provision of mining timber, and laboratory trials have shown the young wood to yield a short-fibred pulp of satisfactory quality, which might be considered for commercial production. A sound line of development in South Africa would appear to be the pulping of surplus plantation timber, provided the site in the forest area fulfils the requirements for a pulp mill, and is within economic distance of the paper mill. The radius of distribution of the latter would obviously have a profitable limit.

Another aspect of wood utilization is presented by the mixed forests of British Guiana, British Honduras, Trinidad, Nigeria and Rhodesia. A great number of woods, both hard and soft, from these forests have been examined at the Imperial Institute, and many of them were found to give pulps of varying character suitable for paper-making. For such sources of pulp it is very important to consider the market to which the product will be sent, and the competition it will have to meet.

An essential to calculating the possibilities of running a pulp mill on the produce of any given forest area is a survey of that forest, which generally is a long and expensive piece of work, and in very few instances has yet been thoroughly carried out. It is obviously unwise to sink capital in the erection of pulping mills, if it has not been definitely ascertained that within economic transport distances the forest contains sufficient trees of the kind required to keep the mill supplied continuously. In this connexion the possibilities of regeneration must be taken into account, and the cycle of reproduction and cutting, which may be 15, 30 or 60 years, worked out.

Bamboos, grasses and reeds.—India, as we have seen, has led the way in using bamboos on a commercial scale, and her pulp industry based on this raw material is well established, thanks to the work of Raitt in demonstrating how bamboos could be profitably converted by a fractional digestion method to good quality pulp. At the Imperial Institute bamboos from East Africa, the West Indies, Malaya and other places have been investigated and shown to be technically suitable for pulp production.

In Trinidad a small mill was established, running on local bamboos, and has operated intermittently.

Bamboos constitute an attractive source of paper pulp which is suitable for high-class book and writing papers, and for mixing with other types of pulp. The establishment of mills running on bamboo has to be viewed in the light of competition with wood pulp, and, apart from India, where they operate under a tariff protection, such mills have not come into operation.

Raitt's review of the possibilities of producing pulp from the extensive resources of bamboo in Burma has pointed out the prospects of that country as a source of pulp for export.

One feature of advantage in respect of bamboos is their quick rate of growth and regeneration.

They can be cut every four years for the pulp mill. This might be given consideration when planning the exploitation of a tropical forest for pulp production. Certain cut-over areas might be brought into quick bearing again with bamboo.

Many grasses and reeds from South Africa, Nigeria and other Empire countries have been examined at the Imperial Institute as paper-making materials, including Lalang (*Imperata arundinacea*), Spanish Reed (*Arundo donax*), Tambookie Grass (*Cymbopogon* spp.), Johnson Grass (*Sorghum halepense*), Elephant Grass (*Pennisetum purpureum*), Norfolk Reeds (*Phragmites communis*), and many others.

Many of the grasses referred to above are capable of yielding pulp of satisfactory properties for use in the paper and board industry, but their application on a commercial scale is in general economically unsound, except under special conditions. *Arundo donax* is, however, employed in Italy for the production of high alpha-cellulose pulps. It is noteworthy that the material is plantation-grown.

We have seen that in India sabai grass is used in the paper making industry, but the available supplies were not large enough to support a major expansion of the pulp industry, for which purpose bamboo was chosen.

The stands of these wild grasses, although very often extensive, are seldom large enough to maintain a mill in operation, since the yield of material per acre is much less than that of forest trees, even taken over a long period of years. Thus, the areas of growth are relatively large and collection from long distances is necessary. Further, the wild stands of growth may be mixed. The question of cultivating a suitable grass on a plantation scale arises, but apart from sabai grass, the extent to which these grasses will stand repeated cropping does not appear to have been ascertained, and the prospects of such enterprise being financially successful in competition with the existing world sources of pulp have so far not looked promising.

The employment of straw, produced as a secondary product in the growing of a food crop, is a different problem.

During the war the esparto-using industry of Great Britain has been converted to the use of straw, and large quantities of bleached paper have been made from this material. To a lesser extent, straw has also been employed for unbleached papers and for board manufacture. Paper-makers in this country have, therefore, gained considerable experience in the technique of handling and processing straw, new processes have been developed and investigated and paper-making engineers have gained knowledge, which, if the need arises, should be of the greatest value in designing new plant specifically for dealing with straw. There are, however, technical limitations to the applications of straw. In strength it cannot equal chemical wood pulps and for printing papers it is inferior to esparto.

Miscellaneous materials.—In the last category of miscellaneous materials mention may be made of nettles.

During the war the possibility of employing nettles for paper-making has received a certain amount of publicity. It is, however, very difficult to believe that such a project could ever be an economic success, and, in fact, this material has not found commercial utilization.

Another type of material, for which there is a limited and relatively very small demand for specialized purposes, is prepared fibre. The industry already uses manila and hemp fibre in the form of old ropes, and recently Yawa fibre has been under consideration. Yawa fibre is produced in Nigeria from the flowering stalks of the legume, *Vigna sinensis* var. *textilis*, and is used locally for making fishing nets.

Following initial experiments carried out at the Imperial Institute on this interesting fibre, more elaborate investigations were organized by the Ministry of Supply, and mill trials were also carried out. The general conclusion reached is that Yawa fibre is the best known substitute for true manila hemp. Paper obtained from Yawa fibre can equal manila in tearing and folding strength, and approach it in tensile strength. Moreover, the yield is satisfactory and the fibre runs well on the machine.

Unfortunately, although technically a very desirable material, Yawa has proved too expensive to find application in the paper-making industry.

Attention has often been paid to the value, for paper pulp production, of industrial wastes other than those arising from the textile and cordage industries, the use of which is well established. Such sources have not provided materials of sufficient quality or in economic quantity to be worth

commercial development except in the case of spent sugar cane, which has been applied commercially, chiefly for the manufacture of building board.

In a review of this nature it has not been possible to deal at length with the properties of the pulps furnished by the various raw materials, which have been mentioned, or to give in detail the conditions of digestion found to be most suitable. Only the more important new materials have been noticed. References to published information are given below. Acknowledgment is made of these sources for much of the matter from which this review of the subject has been prepared, and of our indebtedness for information to the Senior Trade Commissioner for the Union of South Africa; to Mr. A .L. Poole, Scientific Liaison Officer for the New Zealand Government; and to Mr. G. B. Gresford, of the Australian Scientific Research Liaison Office, London.

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Bamboo from Malaya: 24, 1926 (219).
Bamboo from British Guiana: 25, 1927 (370).
British Guiana woods: 22, 1924 (14); 26, 1928 (4); 28, 1930 (411).
Some British Honduras woods: 23, 1925 (12).
Woods from Nigeria: 24, 1926 (8).
Trinidad woods : 30, 1932 (1).
Pinus insignis and *P. patula*: 32, 1934 (343).
Giant grasses: 19, 1921 (174); 33, 1935 (428).
Nigerian grasses: 19, 1921 (271); 20, 1922 (291).
Elephant grass from Sierra Leone: 22, 1924 (420).
Reeds (*Phragmites vulgaris*) from Northern Rhodesia: 28, 1930 (420).
Reeds from Norfolk: 33, 1935 (421).
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Papyrus stems and *Cyperus* sp.; 17, 1919 (152); 18, 1920 (323).
Bagasse (Trinidad): 27, 1929 (1).
Sisal Boles and Poles (Kenya): 27, 1929 (293).
Sisal waste: 28, 1930 (422).
Sisal refuse: 33, 1935 (439).

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ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which a paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

The term "billion" used in papers originating in North America means a thousand million.

0. GENERAL FORESTRY

01. DEFINITIONS. NOMENCLATURE. CLASSIFICATIONS

01.1 : 2. SPURR, S. H. **A new definition of silviculture.** *J. For.* 43, 1945 (44). [1].

The writer criticizes various recent definitions of silviculture and proposes the following new definition: 'Silviculture is the theory and practice of controlling forest establishment, composition, and growth'.

01.2 : 12.25. LITTLE, E. L. **Notes on nomenclature in Pinaceae.** *Amer. J. Bot.* 31, 1944 (587–96). [U.S. Forest Service, Washington, D.C.] O.B.D. [2].

Notes on the nomenclature of species of *Abies, Cupressus, Juniperus, Picea, Pinus, Pseudotsuga* and *Thuja* compiled while the author was checking the scientific names of United States trees in preparation for his new 'Check list of native and naturalized trees of the United States'. No new names or combinations are needed in the Pinaceae, but changes are made in names in use, in authors, and in citation of earlier places of publication.

01.2 : 12.2. RAIZADA, M. B. **A plea for decapitalising specific names.** *Indian For.* 71, 1945 (25–7). [Forest Research Institute, Dehra Dun.] [3].

The author discusses the reasons for and against decapitalization of specific names. He asserts that consistent use of decapitalized specific names would lead to greater uniformity and facility, and urges that a recommendation be made to this effect in the International Rules of Botanical Nomenclature.

01.2 : 12.19. VESTAL, A. G. **Use of terms relating to vegetation.** *Science* 100, 1944 (99–100). [Univ. of Illinois.] P.R. [4].

The author briefly discusses the use and misuse of the terms 'vegetative cover', 'savanna', 'scrub', 'chaparral', and 'jungle'.

01.2–4 (44) : 33.91 : 98.2. CAMPREDON, J. L'application de la normalisation en France à la production, au commerce et à la utilisation du bois. **[The application of standardisation to the production, trade, and utilization of wood in France.]** *Intersylva* 3, 1943 (45–60). [F.g.e.span.f.it.] M.E.W. [5].

Work in connexion with standardization in France was taken in hand as early as 1920 under the direction of a Permanent Board of Standardization whose aim was the 'unification of conditions governing the manufacture and delivery of materials for construction work'. One division of the Board dealt with timber and drew up a series of papers which have formed the basis of all subsequent work. During a later period, beginning in 1930, this work was resumed under the aegis of the 'Commission Générale du bois' of the Association française de Normalisation (AFNOR), the Commission being divided into four working committees. This paper gives an account of the work of the Commission and the standards which it has authorized, and makes a brief review of the ground still to be covered.

01.3 : 01.2 : 12.2. CROIZAT, L. **History and nomenclature of the higher units of classification.** *Bull. Torrey bot. Cl.* 72, 1945 (52–75). [The Arnold Arboretum, Harvard Univ.] O.B.D. [6].

A review of the contributions made by Linnaeus, Adanson, Haller, Gleditsch and others to the development of the present system of plant classification, and some practical considerations on the nomenclature of units above the genus, with particular reference to the current use of standardized endings in the designation of subtribes, tribes, subfamilies and families. It is suggested that names published between the genus and class be honoured for their endings, disregarding, if necessary, the original designation of rank, and that such

names published with formally improper endings in languages other than Latin be legitimized.

01.7. *Mathematical and Statistical Analysis*

01.7 : 31.27 : 38.2. RUFFNER, B. F. **The use of Fourier series in the solution of beam problems.** *Bull. Ore. Engng. Exp. Sta.* No. 18, 1944. pp. 75. [7].

In this bulletin methods are presented for the solution of beam problems by use of the trigonometric series

$$y = a_1 \sin\frac{\pi x}{l} + a_2 \sin\frac{2\pi x}{l} + a_3 \sin\frac{3\pi x}{l} \ \ldots$$

$$+ a_n \sin\frac{n\pi x}{l}$$

for representing the equation of the elastic curve. The coefficients $a_1, a_2, a_3, \ldots a_n$ are constants in any particular problem. Included here is the energy method of determination of these coefficients. Another method for determination of these coefficients, which has a wider practical application, is explained and applied to several typical examples.

The bulletin is divided into three parts. First, the use of Fourier series in the solution of constant *EI* beams is discussed. Applications to both statically determinate and statically indeterminate problems are given. Tables and charts are presented which may be used to reduce the solution of these problems to simple arithmetic. Secondly, an approximate method for obtaining the equation of the elastic curve for beams of constant stiffness is given. Thirdly, a general method for determining the coefficients of the Fourier series is explained. This last method is applicable to beams of varying stiffness, either statically determinate or indeterminate.

The emphasis in the bulletin has been placed on the application of the methods rather than on rigorous mathematical discussion of the principles involved. For this reason lengthy discussions of the convergence of the series representing the bending moment, shear, etc., have been omitted. In most applications the degree of accuracy needed depends on many factors. Usually the stress analyst can make the decision as to the requisite accuracy of his computations, and by reference to examples given he can determine the simplest method of obtaining his desired result. *From author's summary.*

01.7. LANE POOLE, C. E. **Random internal acres.** *Leafl. Commonw. For. Bur. Aust.* No. 54. [n.d.] pp. 8. [8].

In connexion with a study on the relationship of space and increment in plantations of *Pinus radiata* it became necessary to ascertain the rate of increment when thinning was carried out according to a geometric design and when it was done in an entirely random manner. An example is given of how to tally thinnings given a certain degree of severity, making use of random internal acres copied from Kendall and Babington's random numbers.

01.7. LI, J. C. R. **Design and statistical analysis of some confounded factorial experiments.** *Res. Bull. Ia. agric. Exp. Sta.* No. 333, 1944. pp. [4] + (453–92). [9].

02. HANDBOOKS. DICTIONARIES

02.41 (66.9). HIDE, R. H. **The Bini as a botanist. Some notes on the Benin vernacular names of plants.** *Niger. Field* 11, 1943 (169–79). [10].

The article deals with Bini vernacular names for trees and plants, and shows that most of the terms used are generic or purely descriptive. The latter usually derive from comparison of the particular tree or plant with some familiar object in every-day life.

The author gives an appendix of a few of the many interesting Bini names and points out that there is unlimited scope for anyone who might care to tackle the problems of standardization of spelling, both in Bini and the various native dialects of southern Nigeria.

04. MAPS. PHOTOGRAPHY

04.4 : 65. KNUCHEL, H. Über Bestandeskarten und Bestandesprofile. **[On stand maps and profiles.]** *Schweiz. Z. Forstw.* 95, 1944 (373–83 + plates). [G.] [11].

The author recommends the wider use of maps showing the area and composition of forest stands. Topographic maps, old plans, and aerial photographs all have their uses to the forester. The stand map cannot replace the aerial photograph in the portrayal of accurate detail, but it offers more scope for the indication of species and age classes. It is suggested that stand maps (along with maps of

soil, vegetation and stand climax types) should be constructed for every forest at intervals of 30 to 40 years. Illustrated examples are given of stand maps already in existence, and the importance of such maps to future foresters is emphasized.

In cases where figures, verbal descriptions and photographs are not sufficient to give an accurate indication of stand form, drawings of stand profiles may be of great value since they allow horizontal enlargement and a clear representation of the vertical structure of the stand. The method of profile construction is briefly outlined, and examples are given of stand profiles, including a selection forest profile from the Traverstal.

05. PERIODICALS

05.3. *Annual Reports*

05.3 (410). GREAT BRITAIN. **Twentieth annual report of the Imperial Forestry Institute, 1943–44.** University of Oxford. 1944. pp. 12. [12].

05.3 (410). GREAT BRITAIN. **Imperial Institute annual report, 1944.** Imperial Institute, London. [1945]. pp. 67 + plate. [13].

05.3 (41.5). EIRE. **Report of the Minister for Lands on forestry for the period from 1st April, 1938, to 31st March, 1943.** Stationery Office, Dublin [1944?]. pp. 65. [14].

05.3 (485) : 07.2. **Report on the activities of the International Union of Forest Research Organizations, January 1944-January 1945. Annexe** [in English only]: **Report of strain tests of Scots Pine and Norway Spruce, Petawawa projects 52 and 53,** by C. C. Heimburger. International Union of Forest Research Organizations, Stockholm. 1945. pp. 20. [G.E.F.] [15].

05.3 (54.6). JAMMU and KASHMIR. **Progress report on forest administration in Jammu and Kashmir for the half year ending Chet 1998 [1942] and the year 1999 [1943].** The Ranbir Govt. Press, Jammu. 1944. pp. v + 77 + plates. [16].

05.3 (66.9). NIGERIA. **Annual report on the Forest Administration of Nigeria for the year 1943.** Govt. Printer, Lagos, 1944. pp. 36. [17].

05.3 (68.1). BECHUANALAND. **Annual report of the Forest Officer for the year ending 31st December, 1944.** 1945. pp. 3. [18].

05.3 (69). MAURITIUS. **Annual report of the Forest Department, 1943.** Govt. Printer, Port Louis, Mauritius. 1944. pp. 11. [19].

05.3 (71). CANADA. **Twenty-seventh annual report of the National Research Council of Canada, 1943–44.** National Research Council, Ottawa. [1945?] pp. 32 + 35. [E.F.] [*N.R.C.* No. 1243.] [20].

05.3 (71.1). BRITISH COLUMBIA. **Report of the Forest Branch for the year ended December 31st, 1944.** King's Printer, Victoria, B.C. 1945. pp. 79 + plates. [21].

05.3 (71.21). SASKATCHEWAN. **Annual report of the Department of Natural Resources for the fiscal year ended April 30, 1944.** King's Printer, Regina. 1944. pp. 50. [22].

05.3 (71.4). QUEBEC. **Report of the Minister of Lands and Forests of the Province of Quebec for the year ending March 31st, 1943.** King's Printer, Quebec. 1944. pp. 137 + map. [23].

05.3 (729.2). JAMAICA. **Annual report [of the] Forest Department for year ending March 31st, 1944.** Forest Department, Jamaica. [1944?] pp. 5. [24].

05.3 (74). UNITED STATES. **Annual report, 1944: Northeastern Forest Experiment Station.** Northeastern Forest Experiment Station, Philadelphia, Pa. [1945.] pp. 52 [25].

05.3 (77.4). MICHIGAN. **The Department of Conservation: twelfth biennial report, 1943–44.** Department of Conservation, State of Michigan. [1945?]. pp. 303. [26].

05.3 (78.1–3 : 78.7–8). UNITED STATES. **Ninth annual report of the Rocky Mountain Forest and Range Experiment Station.** Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo. 1944. pp. 43 + iii. [27].

05.3 (79.5). OREGON. **Biennial report of the State Forester to the Governor, July 1, 1942, to June 30, 1944.** Oregon State Board of Forestry, Salem, Oregon. 1944. pp. 63. [28].

05.3 (941). WESTERN AUSTRALIA. **Report on the operations of the Forests Department for the year ended 30th June, 1944.** Govt. Printer, Perth. 1944. pp. 12. [29].

05.3 (943). QUEENSLAND. **Report of the Director of Forests for the year ended 30th June, 1944.** Govt. Printer, Brisbane. [1944?]. pp. 3. [30].

05.3 (945). VICTORIA. **Forests Commission of Victoria, Australia. Twenty-fifth annual report, financial year 1943–44.** Govt. Printer, Melbourne. 1944. pp. 35. [31].

06. SOCIETIES. ASSOCIATIONS

06.1 (73). **Society of American Foresters. Constitution and by-laws.** *J. For.* 43 (3), Pt. 2, 1945. pp. 16. [32].

06.1 (77–79) : 43.1 : 60.31.2. MARTIN, C. S. **History and influence of the Western Forestry and Conservation Association on cooperative forestry in the West.** With comment by F. P. Keen. *J. For.* 43, 1945 (165–70). [33].

This paper gives an account of the origin and activities of the Western Forestry and Conservation Association, formed in 1909 with the primary purpose of co-operation against fire loss. It represented 13 private forestry and forest-fire associations and 2 conservation associations in the States of Oregon, Washington, Idaho and Montana, and has since been joined by 3 manufacturers' associations. The aims of the association have expanded and its activities now include the maintenance of a research department.

07. EDUCATION AND RESEARCH

07.1 (45). SALA, G. Les études forestières supérieures en Italie. [**Professional training for the higher forest service in Italy.**] *Intersylva* 3, 1943 (242–53). [F.g.e.span.f.it.] M.E.W. [34].

A brief account of forestry education in Italy up to the foundation in 1937 of the Accademia Militare Forestale, which combined military and forestry training.

07.2 (47.2–6) : 31. PEVTSOV, A. Kh. Problema izucheniya drevesiny. [**Problems of timber research.**] *Lesnaya Prom.* No. 7–8, 1944 (22–5). [Russ.] [35].

The author emphasizes the desirability of timber research, a branch of study which has not been well organized in Russia. The organizations engaged in the study of timber have, so far, dealt only with problems submitted to them by different branches of the Soviet administration. As a result of the war, however, large areas of forest have been devastated, and the problem of their restoration in the shortest possible time has led to the necessity of establishing a special institution, the ILID (Institute for Forest and Timber Research), attached to the Soviet Academy of Science, to study wood and its source, the forest. The author outlines a plan on which, in his view, the future work of the Institute should be based.

09. PRE-HISTORY. FOREST STATISTICS. FOREST GEOGRAPHY

09.2. *Pre-history*

09.2 (44). LEMÉE, G. L'évolution forestière post-glaciaire du Limousin méridional d'après l'analyse pollinique. [**The post-glacial forest evolution of southern Limousin according to pollen analysis.**] *C.R. Acad. Sci. Paris* 216, 1943 (74–5). [F.] P.R. [36].

The results of pollen analyses of peat bogs in the Plateau de Millevaches and the Central Plateau are given, and the vegetational development thus indicated is compared with that on Mt. Doré.

09.2 (74.9). POTZGER, J. E. **Investigations of sediments from nine bogs within the Pine Barrens of New Jersey.** *Abstr.* in *Amer. J. Bot.* 31 (8), 1944 (7s.). [Butler Univ., Indianapolis 7, Ind.] O.B.D. [37].

The nine bogs represent a geographical area extending from the Hollick 'tension zone', in which Monmouth Junction bog is located, to the lower Pine Barrens (Hunters Mills). Eight of the bogs were very shallow, only the one at Upper Longwood Valley reached a depth exceeding seven feet (18 feet). This is also the only station where succession begins with a pronounced Pine/Spruce dominance. In all other bogs succession begins with Pine/Oak, or Pine/Oak/Birch. A strikingly similar forest composition is indicated in the topmost foot-levels of all nine bogs, in which Pine, Oak, Birch, and Chestnut play the most prominent role. In the southernmost station Pine shows greatest abundance in the topmost foot-levels, but at Monmouth Junction Oak exceeds Pine. Because of absence of the Spruce/Pine period in the bottom levels of the eight shallow bogs, and closely similar forest composition shown in the topmost levels of all bogs, the probability exists that the shallow bogs began their

development after the close of the Spruce/Pine period.

09.2 (79.5 : 79.7) : 12.19.4 : 12.25. HANSEN, H. P. **Further pollen studies of peat bogs on the Pacific Coast of Oregon and Washington.** *Bull. Torrey bot. Cl.* 71, 1944 (627–36). [Oregon State College, Corvallis, Ore.] O.B.D. [38].

Pollen analysis of the sediments of a series of six peat profiles extending from Hauser, Oregon, to Hoquiam, Washington, reveals a forest succession from pioneer forests of Lodgepole Pine to climax forests of Spruce and Hemlock. All the bogs, which are of the *Sphagnum* type, are in the climax stage, and are being invaded by forest tree species, particularly Lodgepole Pine (*Pinus contorta*) which is usually the most abundant species in the sand-dune zone and hence preponderant as a seed-disperser. The most important factor influencing normal forest succession in the area is sand-dune movement, since periodic shifting of dunes may bury forests in various stages of succession. The destruction of *Pinus contorta* forest is more readily reflected in the pollen profiles than is the destruction of the climax forests, because the bogs usually lie to leeward of the Pine zone, and the greater amount of pollen produced by this species undoubtedly leads to over-representation. Three of the profiles studied reveal a preponderance of Lodgepole Pine in the lower levels, whereas in the other three profiles this species is recorded as less than 15 per cent. at the lowest horizons but shows slightly different trends upward in the profiles. The climax species, Spruce and Hemlock, show considerable fluctuation in all profiles. Other tree species are only sparsely and sporadically represented. They include Douglas Fir, Western White Pine, Lowland White Fir, Noble Fir, and Silver Fir.

09.2 (54.3) : 12.25. SHUKLA, V. B. ***Dadoxylon resinosum* sp. nov. from the Chhindwara district of the Central Provinces.** *J. Indian bot. Soc.* 23, 1944 (83–90 + plates). [College of Science, Nagpur.] O.B.D. [39].

A description is given of a petrified gymnospermous wood (*Dadoxylon resinosum*, sp. nov.) from the Chhindwara district of the Central Provinces. Like *Dadoxylon deccani* Shukla, the new species shows a combination of alternate and opposite pits and may be regarded as a connecting link between the families Araucarineae and Abietineae. The specific name (*resinosum*) refers to the abundance of a resin-like substance in the tracheids, which seems to be a characteristic feature of the wood.

09.2 : 12.25. HARRIS, T. M. **The fossil conifer *Elatides williamsoni*.** *Ann. Bot.* 7 (*n.s.*) 1943 (325–39 + plates). [Univ. of Reading.] O.B.D. [40].

The author describes both vegetative and reproductive organs of the Middle Jurassic conifer, *Elatides williamsoni* Brongn. and compares the morphology of this species with that of other coniferous genera. He concludes that the fossil species is undoubtedly a member of the Taxodiaceae. It closely resembles *Cunninghamia* in several respects but is not ancestral to it. *Palissya sternbergi* (Rhaetic) is possibly a still earlier representative of the same group.

09.2 : 12.25. FLORIN, R. Zur Phylogenie der Mikrosporen innerhalb der Koniferen und Eibengewächse. **[On the phylogeny of the microspores in cone-bearing trees and Yews.]** *Svensk bot. Tidskr.* 38, 1944 (199–206). [G.] [Naturhistorisches Reichsmuseum, Stockholm.] O.B.D. [41].

A discussion on the phylogenetic development of the pollen grain in gymnosperms, with special reference to external structure.

09.4. *Forest Statistics*

09.4 (41.5) : 96.5. EIRE. **Report of the Minister for Lands on forestry for the period from 1st April, 1938, to 31st March, 1943.** Stationery Office, Dublin [1944?]. pp. 65. [42].

The total national objective of woodland area in Eire, both State and private, has been estimated at 700,000 acres of afforested land, 100,000 acres to be protective forest and 600,000 acres fully productive (p. 4). An area of 29,180 acres was planted during the 5-year period 1938–43, thus bringing the total area of State plantations to 94,530 acres; the total area of productive forest land held by the State in 1943 was 136,574½ acres (p. 18).

09.4 (47.4) : 94.11. KEERDOJA, K. Estlands skogar under krigsåren 1940–44. **[The forest of Estonia during the war years 1940–44.]** *Skogen* 32, 1945 (11–2). [Sw.] [43].

The first detailed census of the Esthonian State forests was completed in 1939; these

forests form 77 per cent. of the total forest area, which in turn represents 21 per cent. of the total land area of the country. Coniferous forests (Pine and Spruce) cover about 70 per cent. of the forest area and these species represent about 77 per cent. of the volume of standing timber; the balance is in broadleaved species.

Figures are given to show the distribution of forest land according to type of ownership in 1940. The two pulp mills in the country were destroyed during the German occupation and a serious paper shortage resulted. R. P. J.

09.4 (481) : 98.1. Opsahl, W. L'economie forestière et du bois en Norvège. [**Forest and timber economy in Norway.**] *Intersylva* 2, 1942 (59–73). [F.g.e.span.ital.] [44].

The export of wood pulp, cellulose and paper products from Norway amounted in 1939 to 1,100,000 tons. On the other hand, the sawmill industry had declined. Two-thirds of the wooded area of the country consists of small and medium-sized private forest property, 13 per cent. belongs to industrial concerns, and about 20 per cent. to the State. The total home consumption of timber in 1941 was 5 million cu. m., while exports amounted to 3·5 million cu. m. Although the total forest area is 7·6 million ha., the area of productive coniferous forest amounts to only 3·7 million ha. Of this area, roughly 65 per cent. is Norway Spruce [*Picea excelsa* (= *abies*)], 20 per cent. Pine, and about 15 per cent. broadleaved trees. The average growing crop is 78 cu. m. per ha. and the increment 2·9 cu. m. per ha. Middle and older age classes predominate. The annual conifer yield in the years 1937–39 amounted to 8·32 million cu. m., and the annual conifer increment (according to the 1919–30 State forest estimate) is 8·37 million cu. m., so that a balance is being maintained between increment and yield. Broadleaved wood production amounts to approximately 2 million cu. m., mainly used for firewood. *From author's summary.*

09.4 (485) : 98.1. Riksskogstaxeringen av Gävleborgs län. [**State forest survey in the Province of Gävleborg.**] *Skogen* 31, 1944 (284–6). [Sw.] [45].

Results from the survey made in 1942 show a total volume under bark, of trees 10 cm. d.b.h. and over, of 105 million cu. m. compared to 104 million in 1926. Species distribution for the 1942 figure is shown as Spruce 45 per cent., Pine 45, Birch 8, and other species 2 per cent. Volume distribution is further analysed according to species, diameter class and types of ownership, and data on annual increment by diameter classes for Pine and Spruce from the 1926 and 1942 surveys are compared. R. P. J.

09.4 (6) : 98.1. Gonggryp, J. W. Die Frage der Holzbilanzen in Bezug auf die afrikanische Forststatistik. [**The question of timber balances in relation to African forest statistics.**] *Intersylva* 3, 1943 (536–52). [G.g.e.span.f.it.] M.E.W. [46].

The African forestry statistics of the International Institute of Agriculture in Rome (*Annuaire International de Statistique Forestière, Tom. III, Afrique*) make an important contribution to the discussion of Africa's position as producer and consumer of forest raw materials. An attempt is made by the author to find out how the statistics could be improved and how far the data available provide material on which to base a timber balance. As the more recent figures on forest areas were not sufficiently uniform to permit of a comprehensive survey of African forests, older figures had also to be used. Taking into account forest area and possible timber production, it appears that Africa has so far contributed only an insignificant fraction of its total potential timber yield. Rubber, tanning materials, oil and cork, which are in many instances the principal forest products, should be added to this. Although incomplete, the data show an adverse timber balance. A rational working of African forests is essential, not only for economic reasons but also for soil conservation. The dangers from abusive exploitation are obvious, but the means of convincing Governments of the reality of these dangers and of the value of the forests are lacking. For this purpose accurate figures for timber production and consumption would be most helpful, and the suggestion made by the International Institute of Agriculture to enlarge and complete the African forestry statistics is welcomed.

09.4 (71.1) : 98.1. British Columbia. **Report of the Forest Branch for the year ended December 31st, 1944.** King's Printer, Victoria, B.C. 1945. pp. 79 + plates. [47].

In connexion with the survey of the natural resources of the North Pacific regions under the sponsorship of the Joint Economic Committee of Canada and the United States [cf.

For. Abstr. 6 (137)], the British Columbia Forest Branch undertook a revision of the forest inventory of the most northerly portion of the Province. A summary of the revised estimates shows that of the total area of over 64 million acres, productive forest land represents only 13·6 per cent., the balance being muskeg or highland barrens, or carrying scrub timber. The total merchantable timber volume of over 4 billion bd. ft. consists of Spruce (55·8 per cent.), Hemlock (24·9), Lodgepole Pine (8·5), Balsam Fir (5·7) and Cottonwood (5·1 per cent.). While the reserves of standing timber are relatively large and the productive forest sites of relatively high quality, the timber is located in long narrow fringes along rivers and watercourses and is difficult of access; it is concluded that the development of the forest industry in this region will be directly dependent on local demand (pp. 14–7).

09.4 (75.5) : 98.1. LOTTI, T., and EVANS, T. C. **The forest situation in the mountain region of Virginia.** *For. Surv. Release Appal. For. Exp. Sta.* No. 15, 1943. pp. iv + 70. [48].

This report is based on the findings of the U.S. forest survey in the mountain region of Virginia, where there are nearly 5 million acres of forest land, or about one-third that for the entire State. Nearly 2 million acres support stands of saw-timber size, of which 1½ million acres are in hardwoods. Net volume of saw timber for the region is shown at nearly 5 billion bd. ft. of which about 75 per cent. is hardwood. Annual net increment of saw timber is given at just over 238 million bd. ft. compared with a commodity drain of 211½ million bd. ft.

09.4 (75.7) : 98.1–2. FROTHINGHAM, E. H., and NELSON, R. M. **South Carolina forest resources and industries.** *Misc. Publ. U.S. Dep. Agric.* No. 552, 1944. pp. 72. [49].

This report is based on the findings of the U.S. forest survey in South Carolina. The forest area was estimated in 1936 at 10,704,100 acres, or 55 per cent. of the land area of the State. About 53 per cent. of the forest area is held in relatively small tracts by farmers, 41 per cent. is owned by pulp and lumber companies, estates, etc., about 5 per cent. is in national forests, and less than 1 per cent. in State and municipal forests. Loblolly Pine (*Pinus taeda*) is South Carolina's most important forest type, occupying more than 4 million acres, while the Shortleaf Pine (*Pinus echinata*) type occupies over 2 million acres and the Longleaf Pine (*Pinus palustris*) type occupies 1,762,000 acres. Hardwoods occupy 2,884,000 or 27 per cent. of the forest area.

In 1936 South Carolina had 30·2 billion bd. ft. of saw timber, of which 61 per cent. was Pines, 34 per cent. hardwoods, and 5 per cent. Cypress.

Average gross drain on saw-timber stands for the period 1936–40 is given as 8,100 million bd. ft., about three-quarters of which was removed by cutting and the remainder destroyed by wind, fire, insects, etc. Average gross increment for the same period is estimated at 8,737·8 million bd. ft.

09.4 (79.5) : 98.1–2 : 60.31 : 33.0. **Forest resources of Oregon: Part I: The forest resource,** by F. L. Moravets. **Part II: Management of the resource,** by N. S. Rogers, W. E. McCulloch and L. F. Cronemiller. **Part III: Utilization of the resource,** by P. M. Dunn. Oregon State Board of Forestry, and School of Forestry Salem; Oregon State College, Corvallis. 1943. pp. 62. [50].

Oregon has the greatest forest resources of any State in the Union, and the management, exploitation and utilization of this resource play a very important part in the economy of the region. The total unreserved commercial forest land was estimated at more than 24 million acres in 1942 with an additional 695,000 acres of reserved land supporting commercial timber stands. The total volume of merchantable saw timber was estimated at 360 billion bd. ft. The first of these papers gives an account of the forest conditions in different areas of the State, statistical data on forest area, saw-timber volume, forest depletion and growth, and brief notes on the range, characteristics and uses of the more important timber species. The second paper gives an account of the development of the timber industries and of forest policies and practices in Oregon, while the third paper discusses the possibilities of increased and more efficient timber utilization.

09.7. *Monographs of Individual Forest Regions*

09.7 (495) : 12.19 : 96.5. ROTHMALER, W. Les conditions forestières du Péloponnèse. **[Forest**

conditions in the Peloponnese.] *Intersylva* 3, 1943 (329–42). [F.g.e.span.f.it.] M.E.W. [51].

Only a small part of the non-forested area of the Peloponnese is cultivated, the remainder being covered with brushwood, heaths and wasteland. The climatic conditions of the country (very wet winters and dry summers) indicate the need for a much larger area of forest than at present exists. In the prehistoric period, the whole peninsula was covered with dense woods, only the mountain areas above 1,800–2,000 m. remaining unwooded. In the valleys and on the coastal lowlands liable to inundation, there were forests of Poplar, Willow and Ash with *Quercus macrolepis* (*Q. aegilops*), which have now almost disappeared; the Mediterranean sclerophilous forest of *Olea* and *Ceratonia*, of which only sparse remnants are preserved, were to be found in the eastern part. In the north-east these have been overgrown by artificially introduced Aleppo Pine (*Pinus halepensis*), whereas forests of this species mixed with *Quercus ilex* are considered autochthonous in the western part. To the west and south, the hill zone extends to the coast: it is characterized by deciduous Oaks, *Quercus macrolepis* in the coastal regions, *Q. frainetto* (= *Q. conferta*) and *Q. brachyphylla* in the interior. The subalpine coniferous zone, between 800 m. and 1,800–2,000 m., consists of forests of *Abies cephalonica* and, less frequently, *Pinus pallasiana* (the latter, however, representing rather a precursory or retrogressive state of development). Broadleaved forests, consisting of mixtures of evergreen and deciduous species are to be found in the gorges and well watered areas, with Planes in the first place.

In most parts, afforestation should present no difficulties; in sclerophilous forest areas, however, the creation of protective, though not highly remunerative, forests of *Ceratonia* will be the chief aim. It is considered that the first steps towards rational exploitation of the existing forest are the construction of roads and a considerable increase of the forest staff.

09.7 (497). WYLIE, N. **Forests in Montenegro.** *Quart. J. For.* 39, 1945 (27–9). [52].

The mountain range to the east of Dermitor in Montenegro rises to over 5,000 ft. and has some fine mixed forests: the species are Spruce, Scots Pine, Silver Fir, Beech, Black Pine, Aspen, Birch (rare), with Juniper as an underwood to Scots Pine. Mixtures usually consist of not more than 2 or 3 species. In the better parts of the forest a feature of the more or less even-aged Spruce stands is their high density of stocking. Fully stocked uneven-aged stands carry a remarkably high volume of standing timber. This is possibly not the result so much of skilful management as of limited exploitation.

An interesting phenomenon is the natural occurrence of Beech above the limits for Pine and Spruce. The altitude record is achieved by a type of mountain Alder, about 2 ft. high.

09.7 (71.8) : 12.19.2 : 23.1 : 32 : 97.1–3. ROBERTSON, W. M. **The forests of Newfoundland.** *For. Chron.* 21, 1945 (11–21). [Dominion Forest Service, Ottawa.] [53].

A brief reconnaissance was made by the author, of the forest limits held by the Anglo-Newfoundland Development Company and Bowater's Newfoundland Pulp and Paper Mills, consideration being given to present conditions and the possibilities of sustained-yield management.

Productive forests cover about 10,000 sq. miles or 25 per cent. of the island and are divided into two forest regions by the Topsail Mountain Range. Sixty per cent. of the forest stands have not yet been disturbed and consequently have no net increment. Areas that have been disturbed by cutting or fire have almost invariably been fully regenerated naturally. On an 80-year rotation the yield from these areas varies from 8 to 48 cords per acre, depending on the site-type.

Six site-types are recognized, four of which bear timber of commercial importance. The main timber species are Balsam Fir and Spruce, with Birch, Maple and scattered White Pine on the better quality sites. Balsam Fir regeneration follows cutting and that of Spruce follows burning, according to the seeding characteristics of the two species.

Recommendations are made with regard to silvicultural research, the improvement of transport facilities and the possibilities of combining fishing and forestry or farming and forestry on a commercial basis.

09.7 (728.6) : 12.26–8. DAYTON, W. A. **Copey Oak in Costa Rica.** *Agric. in Americas* 4, 1944 (134–5). [U.S. Forest Service.] L.S. [54].

In 1942 an extensive stand of giant Oaks was discovered in a hitherto unexplored part of

Costa Rica when the route of the new Inter-American Highway was being surveyed [cf. *For. Abstr.* 6 (137)]. This stand, which is located high on the Cordillera de Talamanca at heights often above 8,000 or 9,000 ft., is now estimated to cover some 30 sq. miles. The species is believed to be *Quercus copeyensis* Muller, first described in 1942 by Dr. Cornelius H. Muller of the U.S. Bureau of Plant Industry. The largest specimens of the newly discovered forest are estimated to be 125 ft. or more in height with a diameter of 7–8 ft. above the buttresses. Extensive areas of the forest average a timber volume of 20,000 bd. ft. per acre.

09.7 (73) : 12.19 : 91 : 4. RANDALL, C. E., and HEISLEY, M. F. **Our forests: what they are and what they mean to us.** *Misc. Publ. U.S. Dep. Agric.* No. 162, (revised edition) 1944. pp. 38. [55].

A third revised edition of a pamphlet, first issued in 1933. Its purpose is to inform the general public on matters relating to forests and forestry in the United States, and deals with the following main subjects: forest ecology; the forest regions of the U.S.; products and uses of the forests; enemies of the forest; forestry in the U.S.; the importance of timber in the national economy.

09.7 (87) : 12.19.1 : 12.2. WILLIAMS, L. Exploraciones botánicas en la Guayana venezolana. I—El medio y bajo Caura. [**Botanical explorations in Venezuelan Guiana. I—The middle and lower Caura.**] Servicio Botanica, Ministerio de Agricultura y Cria [Venezuela]. 1942. pp. 468 + plates. [Span.] [56].

The first portion of the publication gives a general account of the itinerary, including data on the vegetation, topography, soils, climate and communications of the region of the middle and lower Caura, together with a brief resumé of the main agricultural and forest products.

The second part consists of an annotated list of the plant species found in the area. The list includes tree species belonging to 50 families.

A list of vernacular names (with the corresponding scientific name and family of each plant) and a general index are appended.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.4. *Soil*

11.4 : 97.1 (71.3). HILLS, G. A. **Pedology, 'the dirt science', and agricultural settlement in Ontario.** *Repr.* from *Canad. geogr. J.* Sept. 1944. pp. 23. [57].

After a brief general discussion of soil development in relation to environmental factors, an illustrated account is given of the three major soil zones of Ontario, in all of which podzolic leaching is the dominant process in the development of the zonal soils. These are the grey-brown podzolic zone in the south, the brown podzolic zone in central Ontario, and the podzol zone in the north. While leaching is most intensive in the podzol zone and becomes progressively weaker towards the south, the depth of weathering increases from north to south. The fact that podzol and brown podzolic soils are associated with high to very high costs of development suggests a combined economy of agriculture and forestry for most of these lands.

11.41. Soil Physics

11.41.5–6 : 91.1. LUTZ, H. J. **Soil conditions of picnic grounds in public forest parks.** *J. For.* 43, 1945 (121–7). [School of Forestry, Yale Univ., New Haven, Conn.] [58].

From investigations made in two Connecticut state parks on the effect of recreational use on soil conditions, it is shown that as a result of trampling by the public, the soil density is increased and pore volume and air capacity are decreased. Permeability of soils subjected to trampling by the public is but a fraction of the permeability of undisturbed soils.

11.42. Soil Chemistry

11.42.3 (47.2) : 12.19. NIKOLSKY, N. N. **The development of soil acidity as a result of soil-forming processes, and the rôle of plant formations.** *Sborn. Pam. W. R. Williams* 1942 (427–32). [Russ.] S. & F. 7, 1944 (65). [59].

A study of sod podzols in northern Russia has shown that there is a causal connexion between a woody vegetation and an acid soil reaction on the one hand, and a grass vegetation and a neutral or slightly acid reaction on the other.

11.42.34 : 43.3 : 11.44. FINN, R. F. **The leaching of some plant nutrients following the burning of forest litter.** *Black Rock For. Pap.* 1, 1943 (128–34). [60].

An account of an experiment carried out at Black Rock Forest Laboratory, Cornwall-on-the-Hudson, New York, between January 1940 and December 1942, and designed to determine what nutrients were leached from sand and from soil following the burning of forest litter. Two boxes 36 in. × 36 in. × 32 in. were filled, one with beach sand and one with an infertile clayey loam, and holes bored at different depths in the sides of the boxes to allow of the removal of samples. Leaf ash was placed on the top of each box and covered with loam or sand, and the boxes were placed in the open, and sampled at intervals. It was established that when the organic matter is destroyed by fire there is a loss of nitrogen through volatilization. The amount of nitrogen lost depends on the intensity of the fire, the greater the amount of organic matter destroyed the greater the loss of nitrogen. Nitrates, calcium and potassium were lost by leaching from the soil and sand following the burning of the litter. Calcium was lost in the greatest quantities, followed next in order by nitrates. There is some evidence that phosphorus also was leached from both boxes. The addition of the leaf ash changed the soil and sand reaction from acid to alkaline, but at the end of the first year the reaction had again become acid in both boxes.

11.47. Maintenance of Favourable Soil Conditions

11.47.13 : 11.42.3 : 11.43. SÜCHTING, H. Amélioration de la fertilité des sols forestiers et augmentation de la production par le chaulage. **[Improvement of fertility of forest soils and increase of wood production by application of lime.]** *Intersylva* 3, 1943 (1–21). [F.g.e.span.f.it.] M.E.W. [61].

The theory of lime fertilization is discussed and reference is made to the latest research developments in this field. It is pointed out that lime not only counteracts soil acidity, which has been proved to be generally unfavourable to tree growth, but also has a beneficial influence on the biological processes of the soil. The immediate improvement in conditions in the top soil following application of lime is of decisive importance as influencing directly the development of young plants and indirectly the growth of the older trees. It is emphasized, however, that an overdose of lime has a definitely detrimental effect.

Methods of applying lime as a fertilizer are described in detail and data are given on various kinds of lime fertilizers with reference to their characteristics and qualifications. Finally consideration is given to the range of application of lime fertilizers.

11.47.13 : 12.25 : 23.26.4 (75.6). ROSENDAHL R., and KORSTIAN, C. F. **Effect of fertilizers on Loblolly Pine in a North Carolina nursery.** *Plant Physiol.* 20, 1945 (19–23). [Duke University, Durham, N.C.] O.B.D. [62].

The data given in this paper were obtained from field tests with three commercial fertilizers (ammonium sulphate, superphosphate, and potassium chloride) applied singly and in all possible combinations to plots of Loblolly Pine in the nursery of the United States Conservation Service near Chapel Hill, North Carolina. Of the seven single and combination treatments used, ammonium sulphate alone was shown to be effective and financially justified in the amount applied (550 lb. per acre).

11.48. Soil Classes according to their Basic Material

11.48.5 (43.9) : 23.21 : 12.26–8 : 64 : 11.42.1 VAGI, S. Problèmes se présentant en Hongrie dans les recherches sur la pédologie forestière. **[Problems of research in forest pedology in Hungary.]** *Intersylva* 3, 1943 (21–8). [F.g.e.span.f.it.] M.E.W. [63].

There are large areas of calcareous sandy soils in Hungary that receive an average annual precipitation of 500 to 600 mm. but very little during the summer months; these areas might well be afforested with *Robinia pseudoacacia*. Investigations have therefore been made to correlate suitability of individual sites for this species with some measurable factor, particularly the easily soluble P_2O_5 and K_2O content of the soil. Results show that under the conditions of the Hungarian steppes it is not possible to classify soils for this purpose according to nutrient content. The significant factors are soil moisture content and the level of the water table, which explains the value of natural vegetation in classifying these soils, plants being the best indication of the water régime on sandy soils.

In the course of this work it was established that neither the soil's content of easily soluble P_2O_5 nor that of humus undergoes any apparent or regular modification in the course of a year.

11.49. Soil Types

11.49.2 : 12.11.12 : 12.11.23 : 11.41–2 : 42.5. MAGISTAD, O. C. **Plant growth relations on saline and alkali soils.** *Bot. Rev.* 11, 1945 (181–230). [U.S. Regional Salinity Laboratory, Riverside, Colo.] [64].

11.6. *Hydrographical Conditions. Water and Soil Conservation*

11.62.11 : 07.7 : 38.8. GORRIE, R. M. **The place of mechanised equipment in Indian soil conservation.** India and Burma Section of the Royal Society of Arts. [1944?]. pp. 15. [Indian Forest Service.] [65].

The writer emphasizes the importance of the problem of erosion control in India and urges the use of some of the mechanical equipment used in the war, such as bulldozers, excavators, 'Killefer' ploughs and road-graders, for drainage-work, contour terracing, etc. Some experiments have already been made. In the Gurdaspur district of the Punjab, contour terracing has actually been carried out with the use of road-grader machines. On the Ingram estate at Palwal in Gurgaon district a tractor 'Killefer' plough has been successfully used to fracture the deeper subsoil without bringing it to the surface, thus improving porosity without the loss of fertility which often follows deep ploughing. It is suggested that such machinery should be held and worked by the province or other civil government unit, which would have to take over the machinery from the army and build up technically trained staffs to operate and maintain the equipment. A strong and efficient workshop unit, which could travel from district to district, would be essential.

11.62.11 (469) : 38.8 : 23.21 : 12.26–8. SARDINHA, A. M. Tentativa de avaliação de fenómeno erosivo no cretácico da Lousã. Breves notas sôbre os resultados obtidos com algumas obras de hidráulica florestal. [**An attempt at assessing the phenomenon of erosion in the Cretaceous area of Mt. Lousã. Brief notes on the results obtained from some forest hydraulic works.**] *Publ. Direcc. Serv. flor. aqüic. Port.* 7, 1940 (61–110 + dgm.). [Port.port.e.] [66].

This paper gives the results of investigations carried out in the Cretaceous area of Mt. Lousã on the effect of a combination of protective measures such as barricades, fences and plant cover on the erosive action of 15 torrents with catchment areas varying from 50 to 200 ha. in extent. Previous to the introduction of these measures the annual carriage of sand was 101,583 cu. m., whereas the volume of sand carried away after the completion of the anti-erosion measures amounted to only 63,467 cu. m. Among the species successfully used for soil fixation were *Acacia saligna*, *A. floribunda*, *Hakea acicularis* and *H. saligna*.

11.62.11 (82) : 11.41.3 : 64 : 23.21 : 12.26–8. MINTZER, M. J. El control de la erosión en la provincia de Salta. [**Erosion control in the province of Salta [Argentina].**] *Alm. Minist. Agric. Argentina* 17, 1942 (417–24). [Span.] Hort. Abstr. 14, 1944 (317). [67].

Various types of erosion occurring in the province of Salta are discussed and the best way of dealing with them suggested. In the arid and semi-arid regions, land which does not retain 18 per cent. of applied or rain water is not worth cultivating or protecting. Plant indicators of infertile soils are often present: for instance, land on which *Acacia cavenia*, *Caesalpinia praecox*, *Gourliea decorticans* or *Flourensia riparia* predominate can be considered poor, whereas a good proportion of *Prosopis* indicates land sufficiently fertile to be put under cultivation.

Trials at the Puerta de Diaz Experiment Station have shown that a quick and effective means of immobilizing sand-dunes is by planting the shifting banks with *Acacia macrocantha*, *A. cavenia*, or *Flourensia riparia*.

11.62.31 (47.2–6) : 91.3. MURASHEV, S. I. Issledovanie svyazi mezhdu oblesennost'yu vodosborov i polovod'em rek basseyna Oki. [**Research on the connexion between the forest area of catchment and river flooding in the Oka basin.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 2, 1939 (3–21 + maps). [Russ.russ.] [68].

Investigations during 1932 and 1935 in the Oka Basin, where the forest area of individual catchments varies between 4·1 and 35·7 per cent., and the area under conifers between 0·1 and 13·8 per cent., showed that:—(1) Owing to the preponderance (averaging about 75 per cent.) of open land the forests have no significant effect on the time at which the flood

begins in the spring. (2) In 1935 the recurrence of cold weather after the spring thaw resulted in two successive flood peaks; the incidence of the second peak was delayed by 5–6 days and the first peak was less marked in the forested areas as compared with the more open areas. This difference was not observed in 1932 when there was no return of frost after the thaw. (3) At the end of a flood period, as subsidence was beginning, there was more water in those rivers the catchment areas of which had a relatively high percentage of forest. Further investigations are planned by the hydrological laboratory of VNIILKh.

12. FOREST BOTANY. TREE SPECIES

12.1. *General Botany*

12.11. Physiology. Reproduction. Growth

12.11.1. *Metabolism. Plant Constituents. Growth Substances*

12.11.11 : 12.14.5 : 12.25 : 34.25. TSCHUDY, R. H. **The ascorbic acid content of Douglas Fir needles.** *Abstr.* in *Amer. J. Bot.* 31 (8), 1944 (12s.). [Willamette Univ., Salem, Ore.] O.B.D. [69].

Ascorbic acid in Douglas Fir needles is rapidly oxidized when the needles are pulped unless a stabilizer is added. Metaphosphoric and oxalic acids are effective in preventing rapid oxidation. It is impossible to use these acids, however, if the material is to be considered for human consumption. When citric acid was used, slightly lower yields were obtained than when using the other acids. Yields as high as 400 mg. of presumed ascorbic acid per 100 g. of fresh needles were obtained. Seasonal determinations were made, and though the yields were consistently higher in the summer months, at no time were they below 100 mg. per 100-g. sample.

12.11.11 : 12.25–8. BOROVICK-ROMANOVA, T. **On rubidium concentration in plants. II.** *C.R. (Doklady) Acad. Sci. URSS* 44, 1944 (285–8). [E.] L.S. [70].

Data are given on the concentration of rubidium in 56 land plants, including species of *Betula, Picea, Araucaria, Salix, Acacia, Genista, Camellia* and *Buxus*.

12.11.12–3 : 12.25 : 11.11. DECKER, J. P. **Effect of temperature on photosynthesis and respiration in Red and Loblolly Pines.** *Plant Physiol.* 19, 1944 (679–88). O.B.D. [71].

Apparent photosynthesis and respiration were measured in seedlings of Loblolly and Red Pine (*Pinus taeda* and *P. resinosa*) at 20°, 30° and 40° C. A light intensity of 4,500 foot-candles was used for the measurement of photosynthesis. The rates of apparent photosynthesis of the two species were approximately the same at 30° as at 20° C., but decreased about 45 per cent. when the temperature was increased from 30° to 40° C. The rate of respiration of both species doubled when the temperature was increased from 20° to 30° C., and increased about 50 per cent. from 30° to 40° C. The ratio of photosynthesis to respiration for both species was about 13 at 20°, 6·8 at 30° and only 3 at 40° C. Supplementary measurements of photosynthesis at a light intensity of 9,300 foot-candles and temperatures of 19° and 32° C. showed no significant difference in the behaviour of the two species. The ratios of photosynthesis to respiration showed the same proportional decrease with increasing temperature in both species. There was no indication of a gross disturbance of the photosynthetic-respiratory balance of Red Pine at high temperature such as might explain the retarded growth of this species south of its normal range. *Author's summary.* [Cf. *For. Abstr.* 5 (75).]

12.11.14 : 12.26–8 : 12.14.5 : 12.11.12. SANTOS, J. B. DOS. Estomas e actividade estomática no sobreiro. [**Stomata and stomatal activity in the Cork Oak.**] *Publ. Direcc. Serv. flor. aqüic. Port.* 7, 1940 (5–53 + plates). [Port. port.e.] [72].

In order to investigate the influence of stripping on the stomatic activity of Cork Oak leaves, daily counts were made of the number of stomata, both open and closed, on the leaves of young and of mature trees before and after stripping at various levels. In all trees the act of stripping resulted in a complete closing of the stomata, a change which only became apparent 6 to 24 hours after the operation had taken place. The delay in stomatic closure was greater in trees of large dimensions and in cases where stripping had occurred at a low level. The period required for the complete return of the stomata to normal varied from 24 to 30 days. The duration of the period of reduced activity was directly proportional to the level to which

stripping took place and inversely proportional to the dimensions of the tree.

12.11.15 : 12.11.22 : 12.26–8 (213). COOPER, W. C., and STOUTEMYER, V. T. **Suggestions for the use of growth substances in the vegetative propagation of tropical plants.** *Trop. Agric., Trin.* 22, 1945 (21–31). [73].

An effort is being made by the U.S. Office of Foreign Agricultural Relations to develop methods for the rapid propagation of superior yielding strains of such crops as Rubber, *Cinchona*, *Derris* and *Lonchocarpus*. Investigations are being made on the vegetative propagation of these crops, both by rooting of cuttings and budding and grafting. This paper gives information on the use of growth substances in this connexion for the convenience of the investigators concerned. No hard and fast rule can be laid down for the use of these substances; the concentrations required vary with the species, the type and condition of the wood, the method of application, rooting media, and environmental conditions during rooting. The influence of these and other factors is discussed.

12.11.15 : 12.11.22–3 : 23.23.15. FRIEDRICH, H. Über die praktische Bedeutung von Wuchsstoffen in Gartenbau, Land- und Forstwirtschaft. [**On the practical importance of growth substances in horticulture, agriculture and forestry.**] *Angew. Bot.* 25, 1943 (251–73). [Biologische Reichsanstalt für Land- und Forstwirtschaft.] O.B.D. [74].

A brief review of data obtained from literature on the use and properties of growth substances (particularly synthetic growth substances) of the auxin type in the rooting of cuttings, the healing of wounds, the hastening or retardation of bud opening, the ripening of fruit, the promotion of seed germination and of growth in young plants, the setting of fruits, parthenocarpy, and the prevention of premature fruit fall. The bibliography contains 134 references.

12.11.2. *Propagation. Growth. Development*

12.11.21 : 12.26–8. HYDE, H. A., and WILLIAMS, D. A. **Pollen of Lime (*Tilia* spp.).** *Nature, Lond.* 155, 1945 (457). [75].

Comparison of the pollen output of *Tilia cordata* and *Quercus petraea*, a typically anemophilous tree, shows that the former species, in spite of the fact that its flowers produce nectar and are regularly visited by insects, produces and sheds an abundance of pollen. The high percentage of Lime pollen present in some peat deposits and in the atmosphere near Lime trees confirms this view.

12.11.21 : 12.26–8 : 34.26. SAGREIYA, K. P. ***Cryptostegia grandiflora.*** *Indian For.* 71, 1945 (103). [Indian Forest Service.] [76].

In the opinion of the writer, *Cryptostegia grandiflora* is best propagated by direct sowings in manured beds just after the onset of the monsoon. Cuttings strike root readily in July but may suffer heavy casualties later. The surviving cuttings are, however, more vigorous than transplants.

12.11.23 : 11.41.3 : 21.2. KRAMER, P. J. **Soil moisture in relation to plant growth.** *Bot. Rev.* 10, 1944 (525–559). [77].

12.11.3. *Heredity. Breeding. Hybridization. Races and Questions of Provenance*

12.11.3 (73) : 24.3 : 12.25. PEARSON, G. A. **Applied genetics in forestry.** *Sci. Mon., Wash.* 58, 1944 (444–53). P.O. [78].

A general account of the problems and possibilities of forest genetics which can be practised either by artificial propagation of hybrids or selective improvement of natural stands. The author discusses briefly an example of the latter method in the form of an improvement selection cutting designed to favour the best trees in stands of Ponderosa Pine in Arizona.

12.11.3 (485) : 23.23.11. JENSEN, H. Om elitfröplantager. [**On élite seed plantations.**] *Skogen* 32, 1945 (74–7). [Sw.] [79].

The establishment of seed plantations to provide Sweden as rapidly as possible with adequate supplies of high grade seed of forest trees is discussed in detail from the following aspects: (1) the size, scope and distribution of élite seed plantations among forestry concerns; (2) the time needed for such a project and its cost.

To produce the required 75 tons of seed per annum 1,500 ha. of seed plantations in bearing, i.e. about 1,500,000 small trees in bearing, are needed. Two ways of meeting these requirements would be: (1) to start exclusively from grafts of élite clones; or (2) to lay down basic élite seed plantations with the same clones, but

on a much smaller scale, and to select from seed progeny the best 5 per cent. of plants for the laying down of the final seed plantations.

Method (1) would solve the problem of producing sufficient cuttings for scions within four to six years after the first graftings on the élite trees, while method (2) has the advantage that improvement of the quality of the seed in the final seed plantations is possible by selective thinning to increase the dominance of desirable characters over any undesirable ones that cross-pollinated trees (e.g. Pine and Spruce) may carry.

Suggestions on how to obtain an adequate annual supply of young scions are made on the basis of the author's own results, and his findings as regards climatic requirements and provenance as factors in grafting operations in Sweden are also set out.

To ensure that enough new combinations between the genotypes brought together in the seed plots shall ensue, six or more trees per provenance area should be chosen.

The requisite size of the initial plantations for the whole country and the cost of producing plantation seed are discussed, as well as the special applications of such seed plantations to Birch forms.

The instruction and provision of trained staff is necessary to carry out such a programme of seed production. M. L. C. W.

12.11.3 (485). Skogsdagar i Värmland. **[Forestry meetings in Värmland.]** *Skogen* 31, 1944 (279–81). [Sw.] [80].

In the course of a meeting of representatives concerned with forest tree improvement, the woodlands of the Billerud and Uddeholm Companies were visited.

The need for eliminating inferior types which might lower the quality of seed from nearby élite stands selected for seed production was emphasized. Many poor stands can be attributed to inferior uncertified seed from Germany. Official efforts were, however, made to ensure that good seed, suitable to the particular area to be planted, should be available for silviculturists.

A programme has been drawn up for the organization of breeding operations by (1) taking measures to ensure the preservation of élite trees for seed production at various altitudes and latitudes; (2) establishing new élite stands from tested progenies; and (3) rearing scions of the best progeny-tested élites so that seed nurseries or plantations can be laid down for the production of extra high quality élite seed.

Registration of élites is also to be carried out. Measures for inducing seed setting have been undertaken.

Plans for the commercial disposal of improved seed from Ekebo and the other branch stations of the Forest Tree Improvement Association were discussed. The right way to deal with younger stands of inferior types growing in the midst of forests of high quality aroused some controversy; Prof. Sylvén suggested that in less extreme cases, before having recourse to felling, the times of flowering of poor quality and good quality stands should first be ascertained to establish whether pollination of the latter by the former is possible.

A resolution was passed calling for amendment of the existing law on felling, to permit the elimination of types with undesirable hereditary features. M. L. C. W.

12.11.3 : 12.25 (43.1–5) : 23.21. Schmidt, W. Das Ostwestgefälle der Kiefernrassen: neue Einblicke und Methodenvorschläge für internationale Versuche. **[The deterioration of Pine races from East to West: new aspects and suggestions for international experimentation methods.]** *Intersylva* 3, 1943 (473–94). [G.g.e.span.f.it.] M.E.W. [81].

The article begins by stressing the importance of an adequate network of experimental plots for testing the racial qualities of a given species. The testing of seed in widely separated regions is important, as many characteristics become apparent only as site conditions change. Plantation experiments should be so established as to make possible (1) early determination of qualities appearing in the sapling stage of development (after 5–6 years), and (2) the simplification of methods of recording and measuring. The deterioration from east to west of racial qualities in the German Pine of the plain region is taken as an example to show how labour-saving registration methods would make it possible to get some idea of the distribution of types in the various regions even at an early stage of development. Results of experiments, based on observations of 3 million plants from all the German regions of provenance planted in 12 large plots, are discussed under the following heads: sensitiveness to light; disturbances in racial development

caused by climate or human agency; characteristics of the eastern Pine in Baltic regions; plant-substance production capacity; length of trunk; density of crop; resistance to needle-shedding; branchiness; faulty and oblique growth; and healing capacity. The characteristics of the East Prussia race are summed up as follows: (1) it differs markedly from the races found in neighbouring regions; (2) it is superior to Mountain Pine; (3) the differences between this and other races of Pine are recognized soonest and most clearly under optimum growing conditions; (4) according to cultivation tests, at the age of 7 years the East Prussian race is behind in plant-substance production capacity but is superior in regard to possible density of stand, resistance to needle-shedding, branchiness, straight stems in open stands, healing capacity and resistance to climatic conditions. *From author's summary.*

12.11.3 : 12.25. FASSETT, N. C. ***Juniperus virginiana, J. horizontalis* and *J. scopulorum*. I. The specific characters. II. Hybrid swarms of *J. virginiana* and *J. scopulorum*. III. Possible hybridization of *J. horizontalis* and *J. scopulorum*.** *Bull. Torrey bot. Cl.* 71, 1944 (410–8, 475–83); 72, 1945 (42–6). [Univ. of Wisconsin, Madison, Wis.] O.B.D. [82].

A study based on mass collections made throughout much of the ranges of *Juniperus virginiana*, *J. horizontalis*, and *J. scopulorum*, as well as on herbarium material, shows that these three species are always clearly recognizable on a number of characters, except when two species grow together, and that the variation within each species is often more conspicuous than, but never as constant as, the variation which separates species.

Where *Juniperus virginiana* grows by itself, and where *J. scopulorum* grows by itself, each species retains pure specific characteristics, except in areas in the western part of the range of *J. virginiana* where certain tendencies toward *J. scopulorum* suggest an ancient incursion of that species. Where the ranges of the two species meet, all recombinations of the characters of each occur in individuals of one colony. *From author's summaries.*

12.11.3 : 12.26–8. WILKINSON, J. **The cytology of *Salix* in relation to its taxonomy.** *Ann. Bot.* 8 (*n.s.*), 1944 (269–84). [Univ. College, Swansea.] O.B.D. [83].

The chief object of this inquiry has been to gather further information on the karyology of *Salix* and to discover how far this elucidates the phylogeny of the genus.

Several new chromosome numbers are recorded on both base numbers (19 and 22), ranging from *S. bockii*, which is diploid on a base of 19, to *S. glauca*, which is octoploid on the 22-base, and *S. myrsinites*, here found to be decaploid on the 19-base.

Further instances have been discovered of polyploidy within the species unaccompanied by systematic differences, e.g. *S. lapponum* (diploid and tetraploid), *S. myrsinites* (diploid and decaploid).

Certain small but critical differences have been detected between the chromosome complements of synandrous Willows and those of other groups. These involve satellite number and the number of chromosomes with secondary constrictions.

The cytological evidence supports the view held by workers in other fields that the Synandrae are the most recent of the Willows.

Nucleolar number does not correspond with degree of polyploidy in the Salices.

Differential and neutral amphiplasty occur in first-generation hybrids of *Salix*.

The extent to which neutral amphiplasty is manifest appears to depend upon the degree of separation of the species on a widely accepted systematic scheme such as that of Andersson.

Amphiplastic effects are apparently not transmitted to the second hybrid generation. *Author's summary.*

12.11.3 : 12.25–8. BOWDEN, W. M. **A list of chromosome numbers in higher plants. I. Acanthaceae to Myrtaceae.** *Amer. J. Bot.* 32, 1945 (81–92). [McMaster University, Hamilton, Ontario, Canada.] O.B.D. [84].

This and a paper which is to follow, will present cytological data for 179 species of angiosperms and 2 species of gymnosperms, representing 80 genera and 48 families. In the present paper chromosome numbers are given for representative plants in 28 families of angiosperms. They include species of *Asimina*, *Sambucus*, *Euonymus*, *Juglans*, *Persea*, *Sassafras* and *Melia*. The text is illustrated with 120 figures.

12.11.3 : 12.25 : 23.23.3 : 23.24.1. RIGHTER, F. I. ***Pinus*: the relationship of seed size and seedling size to inherent vigor.** *J. For.*

43, 1945 (131–7). [Institute of Forest Genetics, California Forest and Range Exp. Sta.] [85].

In this paper the author presents the hypothesis that in the genus *Pinus* the positive correlation between seed size and seedling size has no genetic basis and therefore no genetic utility. In a number of experiments involving seeds from interspecific hybridizations (*Pinus murrayana* × *P. banksiana* and *P. monticola* × *P. strobus*), from back-crosses and from natural progenies, an attempt was made to isolate and evaluate some of the factors ordinarily associated with vigour in Pines. From the results it is concluded that seed size and seedling size are controlled more by environment than by heredity and cannot, therefore, be used as indicators of inherent vigour.

It is suggested that the hypothesis probably applies to most of the conifers, but not necessarily to the angiosperms, which are characterized by double fertilization, nor to conifers such as *Sequoia sempervirens* and *S. gigantea*, in which the size of the embryo is large in relation to the total size of seed.

12.11.3 : 12.26–8. Löve, A. **A new triploid *Betula verrucosa*.** *Svensk bot. Tidskr.* 38, 1944 (381–93). [E.e.] [Institute of Genetics, University of Lund, Sweden.] O.B.D. [86].

A new autotriploid *Betula verrucosa* (2n=42) from Lövnäs in the province of Värmland is described. Comparisons between the triploid and diploid trees from the same locality indicate that the triploid has larger, thicker and darker green leaves, larger stomata, larger female catkins, and a considerably higher production of wood; the variation with respect to the latter quality within the diploid population is not known. Female fertility in the triploid is almost nil.

It is concluded that, although the triploid trees found in nature indicate that induced polyploidy may be of great value for the breeding of forest trees, experimentally induced polyploids of genotypically high quality are preferable as a basis for breeding purposes. Some methods for the induction of polyploidy in trees are briefly mentioned.

12.11.3 : 12.26–8 (47.2–6) : 31.1 : 23.21. Yablokov, A. S. Ispolinskaya forma osiny v lesakh SSSR [**A giant form of *Populus tremula* in the forests of the U.S.S.R.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz. 'VNIILKh'* No. 23, 1941. pp. 52 + map + tbl. [Russ.russ.] [87].

The Aspen (*Populus tremula*) is one of the most valuable forest species in the U.S.S.R.; the timber is used in several industries, the bark as a source of tannin, twigs and foliage as cattle fodder, and leaves, buds and bark for medicinal purposes. In the past the cultivation of this species has been neglected and little has been done towards controlling Aspen heart rot (caused by *Fomes igniarius*) which is prevalent over extensive areas and greatly reduces the value of many stands. The cultivation of this species is recommended in preference to that of Spruce, as it is an easier species to propagate, less exacting, and there is evidence that it is possible to grow sound high-quality trees.

A Russian giant form of *Populus tremula* has been found in the forests of Sharinsk Province, Gor'kov, on a high, relatively dry site less favourable than the usual habitat of the common form of Aspen. The author, who discovered the giant form in the U.S.S.R., is inclined, unlike the Swedes, by whom it was first discovered in Sweden, to attribute its origin to vegetative propagation; though he does not exclude polyploidy as an alternative. The peculiarities of leaf stomata, tissue cells, and other characteristics which distinguish the giant and other forms from the normal were found to be hereditary and not attributable directly to soil conditions or other factors of the environment. Despite the rapid growth and wide annual rings of the giant Aspen, the high proportion of mechanical tissues renders the wood remarkably close textured and of high quality; it is also characterized by a lower percentage of medullary rays, by longer fibres and larger cells in general than that of the common Aspen. The giant forms also appear to be resistant to heart rot, no sign of disease being found in any of the trees cut to induce suckering.

12.11.3 : 12.25. **Report on the activities of the International Union of Forest Research Organizations, January 1944–January 1945. Annexe** [in English only]: **Report of strain tests of Scots Pine and Norway Spruce, Petawawa projects 52 and 53,** by C. C. Heimburger. International Union of Forest Research Organizations, Stockholm. 1945. pp. 20. [G.E.F.] [88].

The provenance tests described briefly in

the appendix to this report deal mainly with Scots Pine and Norway Spruce material from various parts of Europe. In all cases the seed was sown in October, 1939, and in most cases the plants, either as seedlings (Norway Spruce) or transplants (Scots Pine), have been established in a test plantation. Results thus far indicate that for direct use under the conditions at the Petawawa Forest Experiment Station (Ontario), the best strains of Scots Pine are those from East Prussia, Latvia and Poland, and of Norway Spruce those from Valea Mare, Roumania, from northern Germany and the Black Forest, besides the progeny of selected trees of a plantation already established at the Petawawa Station.

12.11.3 : 12.25 : 12.11.21. Buchholtz, J. T. **The cause of sterility in cross-pollinations between certain species of Pines.** *Abstr.* in *Amer. J. Bot.* 31 (8), 1944 (2s). [Univ. of Illinois, Urbana, Ill.] O.B.D. [89].

Detailed investigations of the ovules in cones obtained in attempted hybridizations of Pines at the Institute of Forest Genetics, Placersville, California, were made in the summers of 1942 and 1944. The conditions observed in the failures fell into three general categories: (1) Cones full grown with ovules only partially developed; (2) cones full grown, ovules normally developed, with the failure at the time of fertilization; and (3) cones full grown with normal fertilization observed in some of the ovules, but where the embryos failed to reach full development.

12.11.3 : 12.25. La Rue, C. D. **Regeneration of endosperm of gymnosperms and angiosperms.** *Abstr.* in *Amer. J. Bot.* 31 (8), 1944 (4s). [Univ. of Michigan, Ann Arbor, Mich.] O.B.D. [90].

Endosperms of *Pinus strobus* and *Tsuga canadensis* were among those removed from their ovules and grown in culture. They attained a large size but did not regenerate buds.

12.13. Embryology

12.13. Johansen, D. A. **A critical survey of the present status of plant embryology.** *Bot. Rev.* 11, 1945 (87–107). [91].

12.13 : 12.25. Boureau, E. Un nouveau type d'évolution du convergent dans l'hypocotyle de l'*Araucaria imbricata* Pav. [**A new type of evolution of the convergent in the hypocotyl of *Araucaria imbricata* Pav.**] *C.R. Acad. Sci. Paris* 216 (9–13), 1943 (418–20). [F.] [92].

Examination was made of the conducting tissue of *Araucaria imbricata* as seen in sections of the root and hypocotyl of young plants at various stages of development. At the point where the root joins the cotyledon the vascular bundles showed typical structure—xylem and phloem alternating.

For the sake of convenience the author refers to a bundle of xylem between two bundles of phloem as a 'convergent'. The formation of the convergents is described with particular reference to the peculiar structure of the hypocotyl of *A. imbricata* where the alternate bundle appears to split into two centripetal rows of vessels which gradually diverge and then become parallel. Occasionally the two rows of vessels are separated by a mass of parenchyma. The illusion of splitting is due to the formation of new vessels. The structure and evolution of the vascular bundles is studied in some detail.

12.13 : 12.25. Schopf, J. M. **The embryology of *Larix*.** *Ill. biol. Monogr.* 19 (4), 1943. pp. 97. [Department of Botany, Univ. of Illinois.] Price $1.50. [93].

The author gives a detailed account of the embryo of *Larix decidua* Mill. from the proembryo stage to embryonic maturity, together with some observations on other *Larix* species. He describes the origin of the various tissues present in the mature embryo and indicates the sequence of development.

Four apical cells are present in the proembryo of *Larix* but only one of these contributes to the mature embryo. The sequence of development resembles that of the embryo of Pine. A section is included on the phylogeny of gymnosperms in general as exemplified by embryonic development.

12.14. Organography. Morphology. Anatomy. Histology

12.14 : 12.11.23. Sifton, H. B. **Developmental morphology of vascular plants.** *New Phytol.* 43, 1944 (87–129). [Department of Botany, University of Toronto, Canada.] O.B.D. [94].

A fairly comprehensive historical survey of the developmental morphology of vascular

plants, including development at growing points; branching; primary vascular tissues; cambia and secondary tissues; and the morphology of individual specialized cells. A final section deals with the experimental approach to developmental morphology.

12.14 : 12.26–8 : 31.1. BAILEY, I. W., and NAST, C. G. **The comparative morphology of the Winteraceae, VII. Summary and conclusions.** *J. Arnold Arbor.* 26, 1945 (37–47). [Biological Laboratories, Harvard Univ.] [95].

A summary is given of the distinctive morphological characters of the Winteraceae. Special reference is made to the characteristic pollen, the vesselless xylem, and the curiously occluded stomata. In considering the composition of the family, the authors give reasons which appear to justify the exclusion of the genus *Illicium*. With its exclusion the Winteraceae becomes a homogeneous natural aggregation of closely related plants, whose genera fall into two distinct categories: (1) *Drimys*, and (2) *Bubbia*, *Belliolum*, *Pseudowintera*, *Exospermum* and *Zygogynum*. The distinguishing features of each category are outlined. It seems probable that the five genera in the second category have developed independently of *Drimys* from earlier and more primitive Winteraceae.

The evolutionary gap between the vesselless xylem of the Winteraceae and the relatively highly specialized vessel-bearing wood of *Magnolia*, *Liriodendron*, and allied genera is so great as to preclude any close degree of relationship between the two groups of plants. Although the Winteraceae are obviously of general ranalian affinities they exhibit no significant evidence of close relationship on the basis of important morphological characters with the Degeneriaceae, Himantandraceae, and Magnoliaceae (*sensu stricto*). Even the salient trends of carpellary specialization are entirely different. The phylogenetic significance of the family lies not only in the retention of a primitive vesselless xylem, but also in the retention of extensive transitional series of carpellary structures illustrating successive stages in the closure and morphological modification of primitive open, conduplicate megasporophylls of the *Degeneria* type.

There is no known species or genus of the Winteraceae, either extant or fossil, from which the rest of the family may be evolved, but many structural species of this hypothetical ancestry can be synthesized from extant species and genera with a high degree of certainty. Others must remain for the present more or less speculative or problematical. The authors present their concept of the ancestral winteraceous stock and of its salient trends of morphological specialization.

12.14 : 12.26–8 : 31.1. BAILEY, I. W. **The development of vessels in angiosperms and its significance in morphological research.** *Amer. J. Bot.* 31, 1944 (421–8). [Harvard Univ., Cambridge, Mass.] O.B.D. [96].

A discussion on the major trends of structural specialization in primary and in secondary xylem and their significance in the fields of comparative and developmental morphology.

12.14.1 : 12.26–8. HULBARY, R. L. **The influence of air spaces on the three-dimensional shapes of cells in *Elodea* stems, and a comparison with the pith cells of *Ailanthus*.** *Amer. J. Bot.* 31, 1944 (561–80). [Department of Botany, Columbia University, New York.] O.B.D. [97].

One hundred and fifty essentially undifferentiated cells from the pith of *Ailanthus glandulosa*, 3,300 elongated cells from the internodal cortex of *Elodea* stems, and 3,000 meristematic cells from the stem tip of *Elodea* were analysed for their three-dimensional shapes.

The average number of contacts in the compactly arranged *Ailanthus* pith cells was 14·23. Pentagonal faces predominated, while the range of faces was from triangular to nonagonal. Eighty-six different combinations of faces were recorded, and 33 of these occurred more than once in 150 cells. *From author's summary.*

12.14.2. SIFTON, H. B. **Air-space tissue in plants.** *Bot. Rev.* 11, 1945 (108–143). [Univ. of Toronto.] [98].

12.14.3 : 12.25. DAY, M. W. **A comparison of the root systems of Jack Pine and Tamarack.** *J. For.* 43, 1945 (41–2). [99].

Report of a study carried out at Dunbar Forest Experiment Station near Sault Ste. Marie, Michigan, on the root systems of Jack Pine (*Pinus banksiana* Lam.) and Tamarack (*Larix laricina* K. Koch). Four trees of each species were selected, with sufficient space for unrestricted root development. Tables are given showing the results of the investigation.

The Tamarack root system was much smaller in lateral extent and shallower than the Jack Pine and was characterized by more profuse branching of the laterals. The volume of the above-ground portion of the largest tree of each species was obtained by the water-displacement method and contrasted with the volume of the roots. The volume of the top included the needles. For Jack Pine the volume of the top was 3,970 cc. and that of the root 1,152 cc., or a root/top ratio of 1 : 3·4. For the oldest Tamarack the volume of the top was 2,335 cc. and that of the root 1,245 cc., or a root/top ratio of 1 : 1·9.

12.14.3 : 12.25 : 12.11.23. KAUFMAN, C. M. **Root growth of Jack Pine on several sites in the Cloquet Forest, Minnesota.** *Ecology* 26, 1945 (10–23). [North Carolina State College, Raleigh, N.C.] [100].

The course of seasonal root growth of Jack Pine (*Pinus banksiana*) was measured in 1939, 1940, and 1942 in several stands in the Cloquet Forest, Cloquet, Minnesota. Air and soil temperature, soil moisture, precipitation, and evaporation were measured in each stand.

For trees 25–28 years old, growth of individual roots averaged from 9 to 12 inches per season, maximum 26·36 inches, minimum 2·54 inches; for 7-year-old trees growing under favourable conditions the average was nearly 15 inches, maximum 24·32 inches, minimum 8·32 inches.

The growing period for roots extended from April to October, with complete dormancy during the winter months. Growth was resumed in the spring after the temperature in the upper six inches of soil rose above 40° F., but was limited until the temperature was over 50° F.; favourable temperatures occurring earliest in a young stand on bare mineral soil and latest in stands with a closed canopy and several inches of litter and mull. A drop in soil temperature to less than 45° F. for a period of six days near the end of September caused root growth to cease. In the absence of such a drop in temperature growth continued into October.

A reduction in the rate of root growth during July and August in stands 25–28 years old was concurrent with a drop in the level of available moisture to less than 4 per cent. and a high rate of evaporation.

A midsummer reduction in rate of root growth in a 7-year-old stand was coincident with a fall in available moisture to less than 4 per cent., but there was no evidence of a marked variation in the rate of evaporation.

Root growth and leader growth started within a week of each other in the spring; however, leader growth was nearly completed by the end of June when less than 50 per cent. of seasonal root growth had been made. *Author's summary.*

12.14.3 : 12.26–8 (81) : 12.11.23. RÊGO, A. Experimento de observaçaodo comportamento de raiz axial do Cajueiro. [**Experiment in observing the behaviour of the axial root of the Cajueiro.**] *Bol. Sec. Agric. Ind. Com., Pernambuco* 11, 1944 (40–5). [Port.] [101].

The principal object of this experiment was to determine the growth of the axial root of the Cajueiro (*Anacardium occidentale*) in relation to the growth of the stem. Observations were also made on the behaviour of the root cap on coming into contact with a 'resistance layer', and on the best size for transplanting. Data are given for the root/stem relationship.

12.14.3–5 : 12.26–8 : 31.1. SINGH, B. **A contribution to the anatomy of *Salvadora persica* L. with special reference to the origin of the included phloem.** *J. Indian bot. Soc.* 23, 1944 (71–8 + plates). [Department of Biology, Dacca Univ.] O.B.D. [102].

A developmental study of the anatomy of stem, leaf and root of *Salvadora persica* L., a tree common in several parts of India. The included phloem of the root and stem of this species is differentiated from the thin-walled parenchymatous cells which are cut off by the cambium on its inner side. The cambium subsequently resumes its normal activity and the phloem becomes more and more deeply embedded in the wood. Comparison of the phloem islands in *Salvadora* with those in *Strychnos nux-vomica* reveals significant differences in origin.

12.14.4 : 12.26–8. ESAU, K. **Vascularization of the vegetative shoots of *Helianthus* and *Sambucus*.** *Amer. J. Bot.* 32, 1945 (18–29). [Univ. of California, Davis, Calif.] O.B.D. [103].

The first sieve tubes of the apical portions of *Helianthus* and *Sambucus* shoots usually differentiate acropetally from the axis into the leaf in continuity with the sieve tubes of the older traces. The continuous acropetal differentiation may be followed, however, by a

discontinuous maturation of the elements composing a given sieve tube: at certain stages one or more series of immature elements may alternate with series of mature elements.

The earliest xylem is initiated in the upper parts of the shoot and differentiates upward toward the apices of the leaves and downward into the axis where ultimately it becomes connected with the xylem of other traces.

In a given leaf the first phloem elements mature before the first xylem elements; in other words, the first phloem differentiates one or more plastochrones in advance of the first xylem. The vascular elements appear first in the median and later in the lateral bundle of a given leaf. *Author's summary.*

12.14.5 : 12.25. Boureau, E. Un nouveau type de faisceau annulaire dans la feuille cotylédonaire de *Libocedrus decurrens*. [**A new type of annular vessel in the cotyledon leaf of *Libocedrus decurrens*.**] *C.R. Acad. Sci. Paris* 216, 1943 (186–8). [F.] P.R. [104].

The author describes a new type of annular vascular bundle found towards the extremity of the cotyledon of *Libocedrus decurrens*. The centrifugal portion is composed of xylem superimposed on the phloem, and the centripetal portion consists of transfusion tissue. It is incorrect to use the term 'centripetal xylem' for the centripetal elements of the transfusion tissue since they are not a direct extension of the alternate xylem of the root and evidently play an entirely different rôle. Moreover, while in the course of development true centripetal xylem always appears before the elements of the centrifugal xylem, the transfusion tissue which immediately adjoins the conducting apparatus proper appears during and after their differentiation. The two types of vessels are therefore very different both in their origin and in the function they perform. The vascular bundles described are comparable neither with those of *Asteroxylon* nor with those observed at a lower level in the middle of the hypocotyl of the same plant (*Libocedrus*). The formation of the bundle is analogous to that of the vessels in the leaf of the Cycades.

12.14.5 : 12.26–8 : 12.12 : 12.11.15. Kholodnȳ, N. G., Yaroschenko, G. D., and Takhtadzhyan, A. L. K eksperimental'noy morfologii i teratologii lista. [**A contribution to the experimental morphology and teratology of the leaf.**] *Bot. Zh. SSSR* 29, 1944 (99–107). [Russ.e.] O.B.D. [105].

In order to produce deviations from normal morphogenesis in leaves, the buds and growing apices of various plants were coated with lanolin · paste containing hetero-auxin and alpha-naphthyl-acetic acid. By this means disturbances of morphogenesis were brought about in the leaves of *Populus* spp., *Tilia cordata*, and *Phaseolus vulgaris*. Treated Poplar leaves showed lengthening, spiral curving, and a screw-like coiling of the leaf stalk. In *Tilia* shield- and funnel-shaped leaves were produced. The most marked deviations from normal occurred, however, in *Phaseolus vulgaris*, where treatment in the very early stages of leaf development gave rise to fusion of the individual leaflets.

It is suggested that morphological differentiation of the leaf depends normally on the presence, concentration and activity of plant hormones of the auxin type, as well as on the stage of development of the leaf rudiments when the influence of the hormones is exerted.

12.14.5 : 12.25 : 11. Stover, E. L. **Varying structure of conifer leaves in different habitats.** *Bot. Gaz.* 106, 1944 (12–25). O.B.D. [106].

In the summer of 1940 the author made a study of the structure of the leaves of *Abies lasiocarpa* (Hook.) Nutt., *Picea engelmanni* (Parry) Engelm., and *Pinus contorta* Loud. from various habitats in the Medicine Bow Mountains. The two first-mentioned species were collected from both the lee and windward sides of the Krummholz at about 11,000 ft., from a mesophytic protected area between 9,000 and 10,000 ft. and from dry granite outcroppings east of Laramie. The specimens of *Pinus contorta* were collected from the most mesic and from the most xeric habitats found in the area. Care was taken to compare only average-sized leaves produced during the same year. Comparative data are given on leaf structure in the various habitats.

12.19. Geographical Distribution. Plant Geography and Sociology

12.19 : 12.26–8. Smith, A. C. **Geographical distribution of the Winteraceae.** *J. Arnold Arbor.* 26, 1945 (48–59). [Arnold Arboretum, Harvard Univ.] [107].

A brief historical sketch is followed by discussion on the probable centre of origin of the Winteraceae and routes of migration leading

to the present distribution of the family. Reliable evidence from early geological horizons is not available, but certain tentative conclusions on the centre of origin are reached on the basis of evidence supplied by the surviving members of the family. The chief centre of diversification and morphological specialization of the Winteraceae appears to have been in Australasia, possibly in the New Guinea–Queensland area; but a great deal of research, especially in palaeobotany, will be required before such speculations can be verified.

Since the seeds of most winteraceous species are of such a morphological type and so perishable as to rule out any possibility of long-distance dispersal by winds, birds, animals, or oceanic currents, terrestrial continuity is regarded as essential for the migration of members of this family, one of whose six known genera (*Drimys*) is found in America. Consideration is given to three possibilities: (1) Matthew's thesis of northern origins and southward migrations, (2) Wegener's hypothesis of continental drift, and (3) Antarctic land connexions. The author believes that distribution in certain groups has probably taken place by trans-Antarctic migrations.

The final section of the article deals with the question of speciation with special reference to the genus *Drimys*.

12.19 : 12.26–8. MOLDENKE, H. N. **The known geographic distribution of the members of the Verbenaceae and Avicenniaceae. Supplement 1.** New York Botanical Garden. 1943. pp. 4. O.B.D.

12.19 : 12.26–8. MOLDENKE, H. N. **The known geographic distribution of the members of the Verbenaceae and Avicenniaceae. Supplement 2.** *Bot. Gaz.* 106, 1944 (158–64). [New York Botanical Garden, New York.] O.B.D. [108].

These supplements contain additions and corrections to the original work [cf. *For. Abstr.* 4, 1943 (157)].

12.19 : 01.7. PENFOUND, W. T. **A study of phytosociological relationships by means of aggregations of colored cards.** *Ecology* 26, 1945 (38–57). [109].

This investigation was concerned with the effects of changes in quadrat size, number of species, and total cover on the sampled frequency, density, and cover of species, by means of an analysis of aggregates of coloured cards. It was found that frequency varies with quadrat size, number of species and total plant cover; density does not vary with quadrat size, but does change with number of species and degree of cover; actual cover per species does not vary with quadrat size but does shift with the number of species or total plant cover; the cover relation among species is unaffected by quadrat size, number of species or total plant cover. Of the three concepts, frequency is the most artificial and least important, and cover is the most valuable, since it is unaffected by quadrat size and delineates relative dominance better than frequency or density does. Size of quadrat is relatively unimportant if frequency is omitted. The number of quadrats to be used as a sample depends on their size; a relatively large number of quadrats, at least ten times the "break in the species-area curve" is necessary to obtain a proper quantitative sample in community analysis. *From author's summary.*

12.19 (45) : 12.25–8 : 22.1–2 : 94 : 33.0. JAMES, N. D. G. **Trees and forestry in Italy.** *Quart. J. For.* 39, 1945 (25–6). [110].

There are three distinct zones, considered from the forestry and arboricultural point of view, in Italy. In the south there is chiefly fruit-growing and olives, with a few scrub woodlands with a preponderance of evergreen hardwoods. In the central district there is a transition from the true Mediterranean species to those of more northerly latitudes, with Oak, Hornbeam and Juniper appearing at the higher altitudes. In the north the trees are those typical of Northern Europe, with a fair proportion of conifers such as Silver Fir (*Abies pectinata*), Norway Spruce and Scots Pine. There are three forest systems; even-aged high forest chiefly Oak or softwoods; coppice-with-standards chiefly Oak; and coppice (or rather maquis) consisting of scrub Oak and Hornbeam for the most part.

The Field Maple (*Acer campestre*) is used as a living pole upon which vines are trained. The Maples are planted in rows about 30 yards apart and 10 yards apart in the rows. When they reach a height of about 18 ft. they are pruned like an apple tree to give a wide open bowl of branches in the centre. The vines are planted next to the trees, trained up and carefully tied back.

Utilization seems to be confined to railway sleepers, timber for joinery, agricultural wagons, and house timber and some furniture. The

railway sleepers are of very poor quality Oak. A great deal of charcoal is produced.

12.19 (469). ROZEIRA, A. A flora da Província de Trás-os-Montes e Alto Douro. Estudo de distribuição geográfica. [**Flora of the Province of Trás-os-Montes and Alto Douro. Study of geographic distribution.**] *Mem. Soc. broteriana* 3, 1944. pp. 203. [Port.f.] [111].

The Province of Trás-os-Montes and Alto Douro possesses a flora which in its general characters represents an intermediary type between the flora of Portugal and that of Spain, as would be expected from its geographical position. The vegetational climaxes discussed in the present work are the *Pinetum maritimae* and various *Querceta*. The 135-page appendix contains a list of species cited for the Province. The list is not claimed to be a comprehensive one.

12.19 (47.2) : 12.25. SOCHAVA, V. B. O genezise i fitotsenologii ayanskogo temnokhvoynogo lesa. [**On the genesis and phytocenology of the Ayansk coniferous forest.**] *Bot. Zh. SSSR* 29, 1944 (205–18). [Russ.e.] O.B.D. [112].

A discussion on the origin and classification of the plant associations of the Ayansk coniferous forests, in which the dominant species is *Picea jezoensis* Carr. and the chief subsidiary species *Abies nephrolepis* Max. and *A. sachalinensis* Mast.

12.19 (47.2) : 43 : 12.25. MELEKHOV, I. S. O vzaimootnosheniyakh mezhdu sosnoyu i el'yu v svyazi s pozharami v lesakh evropeyskogo Severa S S S R. [**The relations between Pine and Spruce with regard to forest fires in the northern European U.S.S.R.**] *Bot. Zh. SSSR* 29, 1944 (131–5). [Russ.] O.B.D. [113].

The Spruce forests of northern U.S.S.R. are mainly riparian and valley forests, and are much less damaged by fire than are the Pine forests on the higher adjacent ground, owing chiefly to a late spring thaw, higher atmospheric humidity, spring flooding, and the presence of fire-resistant herbaceous growth in the Spruce forests.

Contrary to earlier opinions it has now been established that Spruce can invade the Pine types after fire, particularly within the zone of mass seed dispersal from the undamaged Spruce forests. Assuming adequate seeding, factors detrimental to the establishment of Spruce are soil alkalinity and restricted possibilities for mycotrophic nutrition, while Pine reproduction is limited by shade and competition from grass (*Calamagrostis*). Factors significant for the further development of seedlings are soil fertility in the case of Spruce and light for Pine.

From his experience the author has found that, where seed is available, the invasion by Spruce of the *Pinetum vaccinosum* and *hylocomiosum* types is fairly common. In the *P. cladinosum* type, Spruce may become established to a limited extent but Pine is more likely to continue as the dominant. Where Pine is destroyed by crown fire, and where soil and drainage conditions are favourable, Spruce may appear as a pioneer or it may follow the broadleaved species Birch and Aspen.

It is concluded that these findings are of considerable silvicultural significance in relation to the future management of these forests.

12.19 (7). DICE, L. R. **The biotic provinces of North America.** University of Michigan Press, Ann Arbor, Mich. 1943. pp. viii + 78 + map. Price 10*s*. [114].

A biotic province is defined as 'a considerable geographical area over which the environmental complex produced by climate, topography, and soil is sufficiently uniform to permit the development of characteristic types of ecologic associations'. In the present work an attempt is made to describe and map the biotic provinces of North America. Each biotic province covers a considerable and continuous geographical area, characterized, in general, by peculiarities of vegetation type, ecological climax, flora, fauna, climate, physiography and soil, although two or more climax associations may be represented within a single province, especially on mountains, where each 'life belt' may have a different climax. Since one environmental complex usually merges into the other, the boundaries of the biotic provinces are not sharply defined. Moreover, each province is itself in the process of slow evolution. The classification is here based to a large extent on vegetation, as information on plant/animal associations is at present inadequate. However, as animals are directly or indirectly dependent on plants for food and often for shelter and breeding places, vegetation usually offers a satisfactory basis for distinguishing the major ecologic communities.

In general the name assigned to each of the 29 biotic provinces described is that first used by any biologist for that particular biogeographical unit, except in cases where the early name is clearly inappropriate.

12.19 (77.7) : 11.41.8. Loomis, W. E., and McComb, A. L. **Recent advances of the forest in Iowa.** *Abstr.* in *Amer. J. Bot.* 31 (8), 1944 (4s). [Iowa State College, Ames, Iowa.] O.B.D. [115].

Surveyors' records and soil profile data show unmistakably that forest has been invading the prairie of Iowa during the past several hundred years. Thousands of acres of scrubby, brushy forest are now present in western Iowa on land surveyed 100 years ago as prairie with scattered young Burr Oak trees. Invasion is limited to certain soil types and has probably been accelerated by grazing and other disturbance of the original grass cover. In central and northeastern Iowa a comparison of land records and soil structure shows that many thousands of acres of well-drained, silt loam to sandy loam soils had been so recently forested at the time of settlement that the soils retain the characteristics of a prairie profile. Older forests on the same parent material have developed typical forest-soil profiles which show an abrupt transition to forested prairie. These and other data indicate that the present climate of Iowa is that of a forest climax, but that the present era is relatively recent and was preceded by several thousands of years during which prairie was the climax vegetation of the region.

12.19 (77.8) : 42.31. Shull, C. A. **Observations of general vegetational changes on a river island in the Mississippi River.** *Amer. Midl. Nat.* 32, 1944 (771–6). [Univ. of Chicago, Chicago, Ill.] [116].

The 'island' under observation began to form in 1913, and by 1933 it had become part of the mainland of Missouri. In 1922 the vegetation consisted mainly of an almost pure stand of Cottonwood (*Populus deltoides* Marsh.) ranging from 30 to 40 ft. in height. The general vegetational changes on the main part of the former island are discussed briefly. Practically every great flood since 1920 has left the area without undergrowth, but annual plants grow abundantly, and perennials surmount the mud between floods. The taller trees always survive. In addition to the original Cottonwood the tree species now represented include Elm (*Ulmus*), Box Elder (*Acer negundo*), Sycamore (*Platanus occidentalis*) and Mulberry (*Morus*).

12.19 (82) : 09.7. Frenguelli, J. Rasgos principales de fiteografía argentina. [**Main outlines of Argentine plant geography.**] *Rev. Mus. La Plata* 3, 1941 (65–181 + map + plates). [Span.] Herb. Abstr. 15, 1945 (393). [117].

After a discussion of phytogeographical definitions as given by various writers, the author classifies the vegetation of Argentina under the following heads.

I. Formations and associations having trees. A. Rain forest: a close formation, or with clearings very limited in number and extent, of tall trees. B. Woodland: an open formation of trees, sometimes tall but generally of medium height, having more or less numerous and extensive clearings in which an herbaceous plant cover, with or without shrubs, thrives. C. Monte or low woodland: having trees with a mean height of 5 or 6 metres, more or less sparsely placed in large clearings, intermingled with more or less numerous shrubs and tufted herbaceous plants.

II. Formations and associations without trees. D. Shrub steppes: the Patagonian steppe and the highland steppe of the Puna. E. Herbaceous steppes: high table-land steppes, which occupy a very limited area in Argentina, mainly in the provinces of Tucumán, Córdoba and San Luis; and the steppes of the plains, notably the famous Argentine pampa.

III. Transition associations. F. Mixed associations, comprising associations where the transition is gradual, such as the zone between the rivers Negro and Colorado, where the shrub steppe of Patagonia passes gradually into monte dominated by *Prosopis caldenia*; and the associations of the bolsons characteristic of the low central hills and the Andean foothills. G. Parks: associations characterized by groups of trees, more or less numerous and large, interspersed like islands amid associations without trees, and found in Argentina mainly in Tucumán, the Chaco, and the province of Corrientes. H. Savannas: true savanna is nonexistent in Argentina, but in zones of transition between steppe and shrub or tree associations, and also in the wide clearings of the woodlands, there are seen tracts which might be classified as savanna in the wider sense of the term.

I. Fringe forest or woodlands of rivers and water-courses.

The work is illustrated by a map and by fifty-eight plates. It is of great value to the student of South American plant associations, and clarifies many points of terminology which tend to be somewhat ambiguous to those not conversant with South American conditions. At the same time the findings of previous authors are helpfully collated and summarized.

12.19 (91.1). RICHARDS, P. W. **The bio-geographic division of the Indo-Australian Archipelago: 6. The ecological segregation of the Indo-Malayan and Australian elements in the vegetation of Borneo.** *Extr.* from *Proc. Linn. Soc. Lond.* 1941–42. 154th Session, Part 2, 1943 (154–6). [118].

The flora of Borneo consists of two elements of different geographical origin which show a marked tendency to be segregated into different habitats. The dominant flora of Indo-Malayan origin is associated chiefly with the dense, mixed, evergreen rain forests of the lowlands, while the less conspicuous Australian element is represented mainly in the more open formations of 'mossy forest' or montane forest of the mountain ridges above about 3,000 ft., and in certain localized lowland habitats such as the beach forest, the 'heath forest', the *padangs* and the *Melaleuca* swamps.

12.19.1. *Regional Floras, including Check Lists*

12.19.1 (44–6 : 495–6 : 497.1 : 499 : 560 : 56.43 : 56.8–9 : 61–2 : 64–5). BARNEBY, R. C. **A note on the vegetation of the Mediterranean littoral.** *J. N.Y. bot. Gdn.* 46, 1945 (49–54). [119].

Except for relatively restricted areas of desert, the dominant vegetation of the Mediterranean littoral is maquis, an association composed mainly of evergreen shrubs many of which show xerophytic characters. Among the characteristic species belonging to the maquis are *Rhus cotinus*, *Pistacia lentiscus*, *Quercus cerris*, *Arbutus unedo* and *A. andrachne*. Brief sections are included on the flora of sands and rocks, on cultivated crops, and on the weed flora of the region.

12.19.1 (56.43) : 12.26–8 : 23.21. WILLAN, R. G. M. **Deciduous trees in Cyprus.** *For. Treasures* [*J. Cyprus For. Ass.*] 3 (2), 1944 (6–8). [120].

The principal indigenous deciduous trees of Cyprus are Plane (*Platanus orientalis*), Alder (*Alnus orientalis*), Oak (*Quercus lusitanica*), Hawthorn (*Crataegus azarolus*), Terebinth (*Pistacia terebinthus*) and Storax (*Styrax officinalis*); these species probably had formerly a range from near sea-level up into the hills. Several useful exotic species will grow in Cyprus, including Poplar (*Populus nigra*), Willow (*Salix alba*), Walnut (*Juglans regia*), Sweet Chestnut (*Castanea sativa*) and Robinia (*Robinia pseudoacacia*). It is suggested that some of these species might be used as well as the Eucalypts and conifers which are generally favoured in Arbor Day planting.

12.19.1 (581). LINCHEVSKI, I. A., and PROZOROVSKI, A. V. K poznaniyu rastitel'nosti Afganistana. [**A contribution to the knowledge of the vegetation of Afghanistan.**] *Bot. Zh. SSSR* 29, 1944 (114–23). [Russ.e.] O.B.D. [121].

A brief description, from literature, of the vegetation of Afghanistan. Three main types of vegetation are distinguished: (1) desert vegetation, (2) grass vegetation, and (3) arboreal and bush vegetation. The bibliography includes all the botanical papers on the region known to the authors, except papers dealing with the lowest sporophytes.

12.19.1 (66.9). **Key to the forest trees of Southern Nigeria.** *Niger. Field* 8, 1939 (139–64). [122].

The key is divided into sections according to the characteristic feature of the tree, whether bark, slash, habit, leaves, fruit, or flowers. A glossary of botanical terms precedes the key.

12.19.1 (728.4) : 12.26–8. JONGH OSBORNE, L. DE. **Trees of El Salvador.** *Bull. Pan Amer. Union* 77, 1943 (262–8). [123].

Brief, popular notes, with photographic illustrations, on Amate (*Ficus* sp.), Conacaste or Guanacaste (*Enterolobium cyclocarpum*), Palo Volador (*Terminalia amazonia*), Matapalo (*Ficus* sp.), Maquilishuat (*Tabebuia pentaphylla*), and Ceiba (*Ceiba pentandra*).

12.19.1 (75.5). ALLARD, H. A., and LEONARD, E. C. **Additions to the flora of Bull Run Mountain, Virginia.** *Castanea* 9, 1944 (130–4). [124].

A supplement to two papers by Allard and Leonard published in *Castanea* 8, 1943 and 9,

1944, respectively [cf. *For. Abst.* 5 (101)]. Among the species added to those already recorded in the Bull Run area is *Betula lenta* L., a few examples of which are found on Triassic conglomerate soils.

12.19.1 (75.9). MOLDENKE, H. N. **A contribution to our knowledge of the wild and cultivated flora of Florida. I.** *Amer. Midl Nat.* 32, 1944 (529–90). [N.Y. Botanical Garden, New York, N.Y.] [125].

The collections of Florida plants listed in this paper represent 182 botanical families, 737 genera and 1,349 species and varieties, including members of the Taxaceae, Pinaceae, Cupressaceae, Magnoliaceae, Lauraceae, Myrtaceae, Tiliaceae, Bombacaceae, Malvaceae, Caesalpiniaceae, Mimosaceae, Salicaceae, Fagaceae, Casuarinaceae, Ulmaceae, Moraceae, Ilicaceae, Rutaceae, Simaroubaceae, Meliaceae, Anacardiaceae, Juglandaceae, Sapotaceae, Verbenaceae, and Avicenniaceae.

12.19.1 (75.9) : 12.26–8 : 33.12. GIFFORD, J. C. **Trees of South Florida. II. Five native cabinet woods.** *Sci. Mon., Wash.* 59, 1944 (101–7). P.O. [126].

A general discussion on five native trees of southern Florida which produce high-quality timber suitable for cabinet-making: Lysiloma or Wild Tamarind (*Lysiloma bahamensis* Benth.), Mahogany (*Swietenia mahagoni* Jacq.), the Fishpoison Tree or Jamaica Dogwood (*Piscidia communis* (Blake) Harms), False Mastic (*Sideroxylon foetidissimum* Jacq.), and Lignum Vitae (*Guaiacum sanctum* L.). The author suggests that more attention should be paid to the silviculture of these and other valuable native species.

12.19.1 (77.7) : 12.26–8. HAYDEN, A. **A second supplement to the catalogue of Iowa plants in the Iowa State College Herbarium.** *Iowa St. Coll. J. Sci.* 19, 1945 (111–32). [127].

With a few exceptions (indicated in the text), the species and varieties of plants reported in this paper have not previously been listed for the State of Iowa. They include *Quercus velutina* Lam. var. *missouriensis* Sarg., *Q. bushii* Sarg. (= *Q. marilandica* × *Q. velutina*), *Diospyros virginiana* L. var. *pubescens* (Pursh), *Fraxinus americana* L. var. *juglandifolia* (Lam.) Rehder, and *F. pennsylvanica* Marsh. var. *austini* Fernald.

12.19.1 (791.1–3) : 11.45. CLOVER, E. U., and JOTTER, L. **Floristic studies in the canyon of the Colorado and tributaries.** *Amer. Midl. Nat.* 32, 1944 (591–642). [128].

A report based upon collections made during the summers of 1938 and 1939 in the canyon of the Colorado River and its tributaries. After a short review of the geology and physiography of the region, the authors briefly discuss the general vegetation, some typical plant habitats, and plant distribution. A chart is included showing the correlation of species growing under similar conditions in certain selected collection areas, and an outline is given of some relations of birds and mammals to plant life in the canyons. A list of the plants collected is appended. It includes species of *Juniperus*, *Pinus*, *Populus*, *Salix*, *Juglans*, *Quercus*, *Celtis*, *Acacia*, *Cercis*, *Prosopis*, and *Acer*.

Although most of the plants are of a type adapted to conditions of extreme heat and drought, mesophytes and hydrophytes occur in favoured situations.

12.19.1 (82). CABRERA, Á. L., and DAWSON, G. La silva marginal de Punta Lara en la ribera argentina del Río de la Plata. [**The marginal forest of Punta Lara on the Argentine side of the Río de la Plata.**] *Rev. Mus. la Plata* (*Sec. bot.*) 5, 1944 (267–382). [Span.] *Abstr.* in *Trop. Woods* No. 81, 1945 (51). [129].

An ecological study, with an annotated list of plants, of a small natural forest constituting a biological reserve near Buenos Aires.

12.19.1 (86). WOODSON, R. E., SCHERY, R. W., and Collaborators. **Flora of Panama, III. Fasc. I. Juncaceae-Marantaceae.** *Ann. Mo. bot. Gdn.* 32, 1945 (1–105). O.B.D. [130].

In this fascicle are listed plants of the following families: Juncaceae, Liliaceae, Smilacaceae, Haemodoraceae, Amaryllidaceae, Velloziaceae, Dioscoreaceae, Iridaceae, Burmanniaceae, Musaceae, Zingiberaceae, Cannaceae, and Marantaceae.

12.19.1 (93) : 12.26–8 : 07.5. RECORD, M. **A collection of woody plants from Melanesia.** *Trop. Woods* No. 81, 1945 (9–45). [Yale Univ. School of Forestry.] [131].

An annotated list of some 400 woody plants collected in Bougainville, New Britain and various adjacent smaller islands during 1932–36 by J. H. L. Waterhouse of Chatswood, New South Wales. Examination of the herbarium specimens resulted in the generic identification,

at least, of all but seven species, and several undescribed species were discovered. An alphabetical check list of native names is appended. The list presents the native name, botanical name and family of each species.

12.19.1–2 (67.3) : 12.26–8 : 09.7. GOMES E SOUSA, A. de F. Essências florestais de Inhambane. [**Forest species of Inhambane.**] Impresa National de Moçambique Lourenço Marques. 1943. pp. 42 + 36 plates. Biol. Abstr. 19 (3623). [132].

The Inhambane District of Portuguese East Africa is 53,000 sq. m. in area. It has low relief (all below 300 m. elevation) and sandy soil. A belt about 30 km. wide along the coast is more humid and has more even temperature than the interior. Mangrove forests, composed mainly of *Ceriops candolleana*, *Lumnitzera racemosa*, *Bruguiera gymnorrhiza*, and *Avicennia marina*, occur on Inhambane and Pomene Bays. Gallery forests along perennial streams, now mostly destroyed, are dominated by *Barringtonia racemosa*. Sand dunes are covered with scrub woodland of several species, few of which reach timber size on these sites. Open forest, once extending over the entire district, still occupies large areas in the interior. It consists of small, large-crowned deciduous trees, mostly only 5–10 m. high. There are 3 principal subtypes, characterized respectively by *Brachystegia* spp., *Albizzia* spp. and *Isoberlinia globifera*. In some localities there is a denser mixed forest of trees, many of them evergreen, which frequently reach a height of 15–18 m. West of 35° there is a zone of dense 'cimbirre' forest, dominated by *Androstachys johnsonii*, which reaches heights of 12–20 m. The following species are described and illustrated by line drawings of twigs, foliage, flowers, and fruit: *Tamarindus indica*, *Cordyla africana*, *Zizyphus jujuba*, *Dialium schlechteri*, *Cassia petersiana*, *Oncoba spinosa*, *Chrysophyllum welwitschii*, *Mimusops caffra*, *Barringtonia racemosa*, *Millettia caffra*, *Albizzia versicolor*, *Macphersonia hildebrandii*, *Chlorophora excelsa*, *Afzelia cuanzensis*, *Isoberlinia globifera*, *Garcinia livingstonii*, *Ekebergia meyeri*, *Pterocarpus angolensis*, *Erythrophloeum guineense*, *Baphia ovata*, *Phialodiscus zambesiacus*, and *Brachystegia edulis*.

12.19.2. *Forest Types*

12.19.2 (213) : 09.7. RICHARDS, P. W. **The floristic composition of primary tropical rain forest.** *Repr.* from *Biol. Rev.* 20, 1945 (1–13). [Botany School, Cambridge.] [133].

The tropical rain forest is a formation-type or pan-climax. Its outstanding characteristic is the enormous wealth of species of which it is composed. The investigation of the floristic composition of the rain forest presents special difficulties owing to the inaccessibility of the tree-tops, non-seasonal flowering and the backward state of taxonomy in tropical regions. For these reasons little definite information has been forthcoming on the subject until recently and the rain forest in each of the main geographical regions has been regarded as forming a vast assemblage of species varying in composition from place to place and not differentiated into distinct forest types comparable to the associations and consociations of temperate forests.

The floristic composition can best be studied by counting the trees on sample plots, identifying them first by their vernacular names with the help of native 'tree-finders'. With sufficient precautions this method can be made to give results of scientific value.

Primary lowland rain forest may be either Mixed Forest with numerous dominants or one dominant may form a large proportion of the stand.

Mixed rain forests may contain up to 100 species of trees 8 in. diameter and over in a sample plot 400 × 400 ft. The majority of the species in such a plot are represented by one or very few individuals, the average number of individuals per species (*Mischungsquotient*) for trees 8 in. diameter and over being sometimes as low as 2·7. The evidence suggests that in any one geographical area there is only one mixed association whose composition fluctuates in both space and time.

Forests in which one species forms a large proportion of the whole stand are found in all the major tropical regions, but occupy small areas compared with the mixed associations. Some of these single-dominant types are comparable with the consociations of temperate forest climaxes, while others should probably be regarded as societies of gregarious species. In South America and Africa the majority of the dominants of consociations belong to the Leguminosae.

Most, perhaps all, of these single-dominant communities occupy special soils or habitats and it is suggested that they tend to be restricted

to non-optimum soils while the mixed association occupies optimum soils. On similar soils in geographically widely separated areas there tends to be a parallel differentation of edaphic forest types.

.The single-dominant forests can probably be regarded as what Braun has termed 'association-segregates'. If this is so, the tropical rain forests, like the 'Mixed Mesophytic Forest' of North America, would consist of undifferentiated climax associations together with association segregates which are consociations, i.e. associations with a tendency to single-species dominance. *Author's summary.*

12.19.2 (47.1) : 64. CAJANDER, A. K. Nature et importance des types de forêt. [**Nature and importance of forest types.**] *Intersylva* 3, 1943 (169–209). [F.g.e.span.f.it.] M.E.W. [134].

An account is given of the theory of forest types developed by the author as a basis for classifying forest site quality in Finland according to natural plant associations. Individual types are distinguished by permanent, well-marked differences in floristic composition and in ecological and biological characteristics. In each type are grouped those stands the vegetation of which, at or near stand maturity, and provided the stand is normally stocked, has the requisite features, allowances being made for accidental or transitory conditions due to age, fellings, introduction of new species, etc.

The forest types are named according to their most characteristic plant species, abbreviations derived from their Latin names being applied, e.g. CT for *Calluna* type.

12.19.4. *Succession*

12.19.4 (79.4) : 97.3 : 43.3. SAMPSON, A. W. **Plant succession on burned chaparral lands in Northern California.** *Bull. Calif. agric. Exp. Sta.* No. 685, 1944. pp. 144. [135].

A comprehensive study of plant succession on burned areas in the chaparral and Oak woodland associations of California, with special reference to the grazing value of the vegetation. Among the subjects discussed in the booklet are: the ecological characteristics of the chaparral association; viewpoints and practices concerning brush burning; plant succession in relation to burning; the chemical composition of the vegetation on burned and unburned areas; the comparative grazing values of different brush covers; and methods of brushland improvement. A list of the common and scientific names of plants mentioned in the bulletin is appended.

12.2. *Special (Systematic) Botany*

12.21. Fungi

12.21 : 12.11.3 : 44.3. TYLER, L. J., and PARKER, K. G. **Pathogenicity of the Dutch Elm disease fungus.** *Phytopathology* 35, 1945 (257–61). [Cornell Univ., Ithaca, N.Y.] [136].

Culturally distinct races of *Ceratostomella ulmi* originating as sector variants in mass isolates obtained from native diseased American Elm were found to be of unequal pathogenicity, some being strongly pathogenic, others moderately strong, and one practically non-pathogenic. The cultivation of these races on nutrient agar for 7 years, without passing them through the Elm, did not appreciably change their pathogenicity.

12.21 : 44.3 : 12.26–8. FISCHER, H. Untersuchungen über *Massaria macrospora* (Desm.) Sacc., ihre Nebenfruchtform *Coryneum macrosporum* Berk. und *Asterosporium hoffmanni* Kze. [**Investigations on *Massaria macrospora*, its imperfect stage *Coryneum macrosporum* and *Asterosporium hoffmanni*.**] *Phytopath. Z.* 14 (5), 1943 (512–7). [G.] E.S.R. 91 (47). [137].

As a result of the studies reported, it is concluded that this fungus, weakly pathogenic on European Beech, belongs to the Pseudosphaerales rather than to the Sphaerales. Neither on dead twigs or lesions on European Beech or Hornbeam trees nor in agar cultures arising from ascospores of *Massaria macrospora* or conidia of *Coryneum macrosporum* were pycnidia or pycniospores of *Diplodia faginea* detected. These and other experiments described throw doubt on either *D. faginea* or *A. hoffmanni* being connected with *M. macrospora.*

12.21 : 31.42.11. ROBBINS, W. J., HERVEY, A., DAVIDSON, R. W., MA, R., and ROBBINS, W. C. **A survey of some wood-destroying and other fungi for antibacterial activity.** *Bull. Torrey bot. Cl.* 72, 1945 (165–90). [New York Botanical Garden.] O.B.D. [138].

A survey of the antibacterial activity of over 300 wood-destroying fungi, 22 dermatophytes, and about 50 miscellaneous fungi against *Staphylococcus aureus* and *Escherichia coli.*

Over 200 of the fungi studied exhibited some anti-bacterial activity, but none was as effective as *Penicillium notatum* against the two organisms mentioned. Whether the activity of the fungi can be materially increased by the selection of strains or by modification of cultural conditions is not known.

12.21 (79.6–7) : 12.19 : 11.43.1. SLIPP, A. W., and SNELL, W. H. **Taxonomic-ecologic studies of the Boletaceae in northern Idaho and adjacent Washington.** *Repr.* from *Lloydia* 7, 1944 (1–66). [139].

The authors present the results of investigations on the Boletaceae in the *Thuja-Tsuga* zone of the Kaniksu National Forest in northern Idaho and adjacent Washington. The 23 species discussed are believed to include the majority of the boletes occurring in the region. Each species appears to be confined to a particular plant association. The eight stations intensively investigated represent 4 associations:—(1) two areas of herbaceous vegetation resulting from fire and dominated by *Epilobium* spp.; (2) two areas in the *Thuja-Tsuga* climax; (3) one *Pseudotsuga* topographic climax association; and (4) three seral forests.

The boletes constitute one of the few groups of fungi which have been shown to contribute directly to the nutrition of forest trees through their mycorrhizal relations. Known mycorrhizal associates are indicated in the detailed descriptions of species which constitute the main part of the paper. Two types of keys are employed; the first is based on gross characters, ignoring generic differences and was developed mainly for field use. The second key is based on generic distinctions, the five genera represented in the collections being treated separately.

A synopsis of the 16 genera of the Boletaceae as proposed by Snell [*Mycologia* 33, 1941 (415–23) and 34, 1942 (302–11)] is included.

12.25. Gymnosperms

12.25 : 01.2. DOYLE, J. **Naming of the Redwoods.** *Nature, Lond.* 155, 1945 (254–7). [Univ. College, Dublin.] [140].

The question of the generic segregation of *Sequoia sempervirens* and *S. gigantea* is considered in relation to the arguments propounded by Buchholz in favour of such segregation [cf. *For. Abstr.* 1 (247)]. The author discusses at length the fundamental botanical differences in the two species and comes to the conclusion that there is, as yet, no real evidence for generic segregation.

12.25 (410) : 31.41. HOWARD, A. L. **Deciduous Cypress (*Taxodium distichum*).** *Nature, Lond.* 154, 1944 (775–6). [141].

A general discussion on *Taxodium distichum* with reports of the growth of individual trees of this species in England. Few Bald Cypresses have been planted in Britain in recent years. The timber of British-grown trees differs in colour from that of trees grown in America and somewhat resembles Lebanon Cedar in appearance. In both America and Britain the wood has proved to be extremely durable. The author recommends more extensive planting of this useful and beautiful exotic in Britain. In its native habitat it grows in close proximity to streams or abundant water supply.

12.25 (560) : 12.19 : 34.25 : 57 : 60.31. FIRAT, F. Fistik çami ormanlarimizda meyva ve odun verimi bakimindan araştirmalar ve bu ormanlarin amenajman esaslari. [**Investigations on the seed and timber yields of our *Pinus pinea* forests and the principles of management of these forests.**] *Yüksek Ziraat Enst. Çalişmalarindan* 141, 1943. pp. iv + 176 [Turk.g.] [Yüksek Ziraat Enst., Ankara.] Biol. Abstr. 19 (3622). [142].

Forests of *Pinus pinea* occupy 30,000–35,000 ha. in Anatolia, up to 850 m. above sea-level. Their seeds (Pine nuts or pignole) are their most valuable product; timber is secondary. The ecology of the tree and its geographical distribution in Turkey are described in detail. It grows best on well-drained sands and sandy loams. The Pine forests are mostly in poor condition, owing to clearing, fires, grazing. Methods of harvesting the cones and extracting the Pine nuts are described. Average yield is about 125 kg. per ha. The average timber stand is about 130 cu. m. of which 60 per cent. is suitable for timber (Nutzholz). The bark, valuable for tanning, is about 16–18 per cent. of the stem volume. Annual increment is about 3 cu. m. per ha. The tree reaches maturity in 90 years. Natural reproduction is best. Cutting should be done gradually, so as not to expose the soil. Stands should be thinned every 5th year or every 4th year where the trees are worked for resin. There should be about 110–120 trees per ha. at 45–50 years. The morphological and anatomical characteristics of

the tree and the technical properties of its wood are described.

12.25 (81) : 33.0. DEVOTO, F. E. El *Pinus caribaea* o pino tea Cubano. [***Pinus caribaea* or Cuban Pitch Pine.**] *Mundo maderero* 5 (59), 1945 (5–6). [Span.] [143].

The author reviews the desirable qualities of *Pinus caribaea* and recommends more extensive planting of this species in Argentina. In addition to providing timber, resin and turpentine, the Cuban Pine is a suitable species for paper-making.

12.25 (931) : 21.12 : 12.11.3. MOORE, A. M. ***Pinus ponderosa* (Douglas): comparison of various types grown experimentally on Kaingaroa State Forest.** With comment by A. N. Perham. *N.Z.J. For.* 5, 1942–44 (42–9). [144].

The central and southern portions of the Kaingaroa Plains, Rotorua District, are characterized by considerable areas of 'frost flats', on which only two tree species have been successfully established—*Pinus ponderosa* and *Pinus contorta* var. *murrayana*. Investigations have been made on seed collected from 13 localities in North America with a view to determining the type of Ponderosa Pine best suited to this locality. Seed was sown in 1927, and in 1929 1–1 transplants were planted out in plots. The conclusion reached was that, of the various types tried, those from the Eldorado County in Northern California are the best. Tables are given showing the data collected on the 13 sites. In his comment Mr. Perham refers to areas from which the seed was collected in North America and briefly describes the three main varieties or types of Ponderosa Pine found in the 'Inland Empire' region of the United States.

12.25–8 : 23.27. REHDER, A. **Notes on some cultivated trees and shrubs.** *J. Arnold Arbor.* 26, 1945 (67–78). [Arnold Arboretum, Harvard Univ.] [145].

New combinations or changes of category are given for cultivated species of *Taxus, Chamaecyparis, Juglans, Hamamelis, Clematis, Crataegus, Amelanchier, Zanthoxylum, Rhododendron, Syringa, Lavandula* and *Viburnum*. Notes are also included on Pinaceae subfam. Taxodioideae, comb. nov., and Gramineae subfam. Bambusoideae, comb. nov.

12.26-8. Dicotyledons

12.26–8 (410) : 33.0. HOWARD, A. L. **The Horse-Chestnut tree (*Aesculus hippocastanum*).** *Nature, Lond.* 155, 1945 (521–2). [146].

Aesculus hippocastanum was introduced into Great Britain in the middle of the sixteenth century. Avenues of this species became fashionable in the time of John Evelyn, and many famous examples of trees dating from that time still survive. Both the Horse Chestnut and the Sweet Chestnut (*Castanea sativa*) (with which it is sometimes confused) are subject to the defect of spiral growth in the British Isles. Reference is also made to the Yellow Horse Chestnut (*Aesculus octandra*), introduced in England in 1764, the Red Horse Chestnut (*A. carnea*), introduced in 1818, and a red-flowered shrub, *A. pavia*. Shipments of Japanese Horse Chestnut (*A. turbinata*) timber, which arrived in London about 1920, realized high values for the manufacture of art furniture. The timber of *Aesculus hippocastanum* grown in Britain is of moderate weight, fine-grained but perishable. It is used for charcoal, furniture manufacture, and for works of decorative art.

12.26–8 (410) : 12.19 : 12.14 : 21 : 12.22.1. JONES, E. W. **Biological flora of the British Isles. *Acer* L.** *J. Ecol.* 32, 1945 (215–252). [147].

After a brief description of the characteristic features of the genus *Acer* the author discusses the morphology of *Acer pseudo-platanus* L. and *A. campestre* L. and lists the insects and fungi associated with the genus. The main part of the work deals with the two above-mentioned species under the following headings: (1) geographical and altitudinal distribution; (2) habitat; (3) communities; (4) response to biotic factors; (5) gregariousness, performance, effect of frost, drought, etc.; (6) morphology and vegetative biology; (7) phenology; (8) reproductive biology; (9) parasites and diseases; and (10) history. *Acer platanoides* is dealt with only briefly. It resembles Sycamore (*A. pseudoplatanus*) in most features of its biology.

12.26–8 (494) : 23 : 24 : 33 : 44.3 : 45.3. BARBEY, A. Le peuplier: son utilité et l'extension de sa culture en Suisse. [**The Poplar: its utility and the extension of its cultivation in Switzerland.**] Inspection des forêts, chasse et pêche, Département fédéral de l'intérieur, Berne 1942. pp. 63. [F.] [148].

The Poplar has been heavily exploited in Switzerland during the war to take the place of imported timber, and it is most desirable that these heavy cuttings should be compensated by planting. This pamphlet gives an account of the genus, including various hybrids which are particularly favoured in Switzerland, soils and associations favourable to their growth, reproduction, planting and tending, enemies and utilization. A special plea is made for the planting of Poplars along canals, rivers and roads.

12.26–8. GROSSHEIM, A. A. Novȳ piramidalȳ topol'. **[A new pyramidical Poplar.]** *Bot. Zh. SSSR* 29, 1944 (124–5). [Russ.] O.B.D. [149].

The new species, *Populus schischkini*, is described. It is found in gardens in Transcaucasia and attains a height of 20–30 m.

12.26–8 (51). WEI-PEI FANG (Ed.). *Icones Plantarum Omeiensium* 1 (2), 1944. pp. viii + [106]. [Chin. E.] [The National Szechuan Univ., Szechuan, China.] [150].

The present number, which is the second of the series, contains illustrations and descriptions in English and Chinese of 50 species of plants (including 2 new species) found on Mount Omei in the southwestern corner of Szechuan Province. Tree species from the following genera are included: *Aesculus*, *Euptelea*, *Tetracentron*, *Cercidiphyllum*, *Decaisnea*, *Turpinia*, *Manglietia*, *Magnolia*, *Clerodendron*, *Carrierea*, *Itoa*, *Idesia*, *Lyonia*, *Melliodendron*, *Albizzia*, *Ormosia* and *Stachyurus*.

12.26–8 (51). HUI-LIN LI. **New Kwangsi plants.** *J. Arnold Arbor.* 26, 1945 (60–6). [Arnold Arboretum, Harvard Univ.] [151].

In this paper several new species and varieties, based on types from Kwangsi Province, China, are described, including the following trees: *Photinia kwangsiensis*, sp. nov.; *Tutcheria hirta* var. *cordatula*, var. nov.; *Hartia cordifolia*, sp. nov.; *Adinandra bracteata*, sp. nov.

12.26–8 (54.3) : 34.26 : 21 : 45.12. DAVER, S. R. ***Prosopis juliflora* in Jalgaon Range, West Berar Division, Central Provinces and Berar.** *Indian For.* 71, 1945 (119–24). [152].

Observations on *Prosopis juliflora* made by the writer after a visit to the Bhongaon forests in the Jalgaon Range in February 1943. Two species of *Prosopis* (*P. glandulosa* Torr. and *P. juliflora* D.C.) were formerly grown in this area, but experience has shown that the former is of little value. Some opinions expressed by forest officers who have had to deal with plantations of *P. juliflora* in West Berar are quoted and commented upon. The writer does not believe that branching at ground level is connected with methods of sowing or that the volume of outturn of *P. juliflora* timber compares favourably with that of Babul (*Acacia arabica*). Although *P. juliflora* will grow in calcareous soils where Babul fails or remains stunted, it does require a certain depth of soil and survives only for one or two years on shallow soils.

The economic uses and silvicultural characteristics of *P. juliflora* are reviewed. Best growth can be expected in deep sandy soils where the long tap root has full scope for development. Severe damage may be caused to both seedlings and trees by the field or antelope rat. Destruction of the terminal shoot of a seedling or the gnawing of the roots of an older tree by rats probably increases the natural tendency of the plant to low lateral branching.

Owing to its thorns and long lateral branches, *P. juliflora* is very unpopular for combined agriculture and forest operations. However, the seeds are easy to germinate and the plants require little attention after the first year. The planting of this species is recommended on calcareous soils unsuitable for Babul.

12.26–8 (54.8) : 23.2. GHATE, N. S. ***Cryptostegia grandiflora*—some further records of occurrence and an experiment in growing it from seed.** *Indian For.* 71, 1945 (24). [153].

Healthy plants were raised from *Cryptostegia grandiflora* seeds sown at Cocanada [Madras] in October, 1943, and later transplanted along a compound hedge near *Eucalytus rostrata* for support. Early progress has been encouraging but evidence as to how the plants will stand the hot weather is not yet available.

12.26–8 (59.6–9). HUI-LIN LI. **Further notes on the flora of Indo-China.** *J. Arnold Arbor.* 26, 1945 (119–21). [Arnold Arboretum, Harvard Univ.] [154].

A new tree species from Annam, *Hydnocarpus annamica*, has been added to the members of the Flacourtiaceae in Indo-China. The

families Elaeocarpaceae, Theaceae, Melastomataceae and Verbenaceae are also represented.

12.26–8 (7). CRONQUIST, A. **Studies in the Sapotaceae. I. The North American species of *Chrysophyllum*.** *Bull. Torrey bot. Cl.* 72, 1945 (191–204). [New York Botanical Garden, New York.] O.B.D. [155].

The genus *Chrysophyllum* consists of shrubs or small to medium-sized trees. In this paper the author gives a key to the twelve species found in North America, Mexico, Central America and the West Indies (exclusive of Trinidad and Tobago) and describes each species together with type, distribution and local name where these data are available. Descriptions of two new species (*Chrysophyllum brenesii* Cronquist, and *C. hirsutum* Cronquist), three new varieties (*C. oliviforme* var. *typicum* Cronquist, *C. mexicanum* var. *typicum* Cronquist, and *C. mexicanum* var. *politum* Cronquist) and one new combination (*C. oliviforme* var. *picardae* (Urb.) Cronquist) are included.

12.26–8 (72) : 01.2–3. MCVAUGH, R. **The Jatrophas of Cervantes and of the Sessé and Mociño Herbarium.** *Bull. Torrey bot. Cl.* 72, 1945 (31–41). [U.S. Bureau of Plant Industry Station, Beltsville, Md.] O.B.D. [156].

On the basis of specimens in the herbarium of Sessé and Mociño it is now possible to identify most of the *Jatropha* species described by Sessé and in a paper by Cervantes in 1794. Three new names are proposed, and seven others are relegated to synonymy.

12.26–8 (76.6). LITTLE, E. L. ***Acer grandidentatum* in Oklahoma.** *Rhodora* 46, 1944 (445–50). [U.S. Forest Service, Washington, D.C.] O.B.D. [157].

The author regards the Bigtooth Maple of the Wichita Mountains, southwestern Oklahoma, as a distinct species, *Acer grandidentatum* Nutt. The disjunct distribution and habit of this western species are briefly discussed and compared with those of the eastern Sugar Maple (*Acer saccharophorum* K. Koch) which occurs further to the east in the same State. A new combination, *Acer grandidentatum* var. *sinuosum* (Rehd.) Little is proposed.

12.26–8 (81) : 31.1. DUCKE, A. ***Dicymbe heteroxylon*, a giant tree with anomalous wood.** *Trop. Woods* No. 81, 1945 (6–9). [158].

The species described (*Dicymbe heteroxylon* Ducke, sp. nov.) occurs in the upland rain forest of the western part of the Brazilian State of Amazonas. It is noteworthy because of its large size and the anomalous structure of its wood. It differs from other species of the same genus by the more numerous and smaller leaflets, by the sharp keel of the united bractlets, by the smaller flowers, and by the very short receptacle.

A note is added on the enigmatical species, *Thylacanthus ferrugineus* Tul. which has been placed near *Dicymbe* because of its bractlets and the central insertion of the ovary.

12.26–8 (81) : 31.2 : 33.0. KUHLMANN, M., and VIANNA, A. As madeiras nacionais na paz ou na guerra. 'Açoita cavalo', *Luehea divaricata* Mart. e espécies afins (Tiliaceae). **[The national timbers in peace and war: *Luehea divaricata* Mart. and related species (Tiliaceae).]** *Repr.* from *Relat. Inst. Bot. Brasil* March, 1944 (105–26). [Port.] *Abstr.* in *Trop. Woods* No. 81, 1945 (51). [159].

A comprehensive account of an important timber tree of southern Brazil. The wood, which has many of the properties of Birch (*Betula*), has proved particularly useful for certain military purposes, such as gunstocks, aeroplane propellers, and plywood.

12.26–8 (81) : 34.25–7 : 12.14 : 09.2 : 12.11.3. MACHADO, O. Estudos novos sobre uma planta velha o cajueiro (*Anacardium occidentale* L.) **[New studies on an old plant, the Cajueiro (*Anacardium occidentale* L.).]** *Rodriguésia* 8 (17), 1944 (19–48 + plates). [Port.] [160].

A comprehensive account dealing with many widely different aspects of the species *Anacardium occidentale* L., including nomenclature, histology, the medicinal and industrial uses of the plant and its products, insect and fungous pests of the plant, and Brazilian legislation pertaining to this most important species.

Paleobotanical studies indicate that the family, Anacardiaceae, probably dates back to the Tertiary period. The eleven species of *Anacardium* at present found in America are *A. occidentale* L., *A. rhinocarpus* DC., *A. giganteum* Hancock, *A. spruceanum* Benth., *A. corymbosum* B. Rod., *A. humile* St. Hil., *A. microsepalum* Loesn, *A. parvifolium* Ducke, *A. tenuifolium* Ducke, and *A. microcarpum* Ducke. Of these, only one (*A. rhinocarpus*) does not occur in Brazil. A short key to the American

species of *Anacardium* is given, and *A. occidentale*, the most common and widely distributed of these, is described. The description is preceded by a list of the scientific and vernacular synonyms.

A fairly large section of the work is devoted to the histology of the plant, which is studied in some detail. The chromosome count is 2n = 30. The importance of *A. occidentale* in the lives of the people of Brazil may be judged from the list of terms incorporated into the language which refer directly or indirectly to the Cajueiro or its products.

12.26–8 (82) : 23.21 : 31.2. ALFONSO, J. L. Algarrobo blanco: es una valiosa especie indigena. [***Prosopis alba* Griseb.: a valuable indigenous species.**] *Mundo maderero* 5 (56), 1944 (10–2). [Span.] [161].

A general discussion on *Prosopis alba* (Algarrobo Blanco, Ibopé, Ibopé-pará) taken from the author's book, 'Forestales indígenas de la Argentina'. Reference is made to the suitability of the species for afforestation in areas suffering from, or liable to, erosion. The wood is hard and heavy. At 12 per cent. moisture content it weighs 725 to 750 kg. per cu. m.

12.26–8 (82) : 12.19 : 31.0. ALFONSO, J. L. El Itin. [***Prosopis kuntzei* Harms.**] *Mundo maderero* 5 (58), 1945 (11–3). [Span.] [162].

A general account of *Prosopis kuntzei* Harms (known locally as Itin, Jacarandá, Barba de Tigre, Carandá, and Palo Mataco) from the author's book, 'Forestales indígenas de la Argentina'. Reference is made to the appearance and distribution of the species, its varieties, the characteristics and uses of the timber, site requirements and germinative capacity.

12.26–8 (91–2). MERRILL, E. D. ***Ochrocarpus odoratus* (Rafinseque) Merrill, a new name for a much named species, with a new species from Samoa.** *J. Arnold Arbor.* 26, 1945 (93–6). [Arnold Arboretum, Harvard Univ.] [163].

The author discusses the synonymy of the widely distributed littoral tree species currently known as *Ochrocarpus excelsus* Vesque and as *O. ovalifolius* T. Anders., and proposes a change in nomenclature in accordance with the International Code of Botanical Nomenclature. He suggests the new combination *Ochrocarpus odoratus* (Raf.) Merril. A description of the new species *Ochrocarpus glaucus* is appended.

12.26–8 (932–9). SMITH, A. C. **Studies of Pacific island plants, IV. Notes on Fijian flowering plants.** *J. Arnold Arbor.* 26, 1945 (97–110). [Arnold Arboretum, Harvard Univ.] [164].

A number of species in various families are discussed, five species being described as new, including three trees: *Elaeocarpus pittosporoides*, *Tapeinosperma greenwoodii*, and *Mastixiodendron pilosum*.

12.26–8 (95). MERRILL, E. D., and PERRY, L. M. **Plantae Papuanae Archboldianae, XV.** *J. Arnold Arbor.* 26, 1945 (1–36 + plate). [165].

The species listed in this section are mainly herbaceous, and include many epiphytic plants, such as *Hydnophytum hahlii*, a small tree reported from mountain forests in San Cristoval, Solomon Islands.

12.26–8 : 12.14.4–5 : 13.2 : 13.15 : 45. SKUTCH, A. F. **The most hospitable tree.** *Sci. Mon., Wash.* 60, 1945 (5–17). P.O. [166].

A general description is given of the appearance, distribution and mode of growth of *Cecropia* spp. in the New World tropics. Among the distinctive features of these trees is their myrmecophilous habit. Three structural peculiarities that particularly favour the harbouring of ants are (1) the exceptionally wide central hollow of the stem, (2) the furry protruding leaf bases with their protein bodies, and (3) the pits which facilitate the perforation of the wall surrounding the hollow internode. Investigations tend to discredit the view held by some botanists that the ants, in return for shelter and the food provided by the protein bodies, act as a garrison to protect the trees from foliage-eating insects, browsing mammals, and other destructive agents. The *Azteca* ants commonly found in *Cecropia* trees undoubtedly destroy a small percentage of certain harmful insects (such as leaf-eating ants of the genus *Atta*) but they are not an effective protection against pests in general. Since their mode of attack is entirely mechanical and they inject no venom into the victim, they are among the less formidable species of ants. They appear to have little, if any, effect on the depredations caused by monkeys, the three-toed sloth (*Bradypus griseus*), the big pileated

woodpecker (*Ceophloeus lineatus*), and insect pests. The *Azteca* ants themselves appear to be neither beneficial nor directly harmful to the tree.

13. FOREST ZOOLOGY

13.1. *General Zoology*

13.15 : 13.2 : 45.3. ROSENSTIEL, R. G., FERGUSON, G. R., and MOTE, D. C. **Some ecological relationships of *Cnephasia longana*.** *J. econ. Ent.* 37, 1944 (814–7). [Oregon Agricultural Exp. Sta., Corvallis.] [167].

Observations on the life history, feeding habits and ecological relations of the lepidopterous pest, *Cnephasia longana* Haw. Tests with wooden blocks of various species confirmed that oviposition usually takes place on the trunks of rough-barked trees such as *Abies grandis, Juglans nigra, Pseudotsuga taxifolia* and *Acer macrophyllum*. Douglas Fir and Oak trees are the most important sources of drifting larvae in the Willamette Valley (Oregon). Legumes such as vetches, clovers and alfalfa, are the principal food plants of *Cnephasia* larvae, but much damage is also caused to economic crops such as flax, especially in the vicinity of the host trees from which the windborne larvae are transferred after they emerge from hibernation in the early spring.

13.15 : 13.2 : 45.3 : 12.26–8. RICHTER, A. A. O lichinkakh i ekologii zhukov-zlatok roda *Lampra* Lacord. (Coleoptera, Buprestidae). **[The larvae and the ecology of beetles of the genus *Lampra* Lacord.]** *Izv. Akad. Nauk SSSR* No. 1, 1944 (59–64). [Russ.e.] O.B.D. [168].

Like the European species of the genus *Lampra* (Buprestidae), the Far Eastern species are dangerous pests of forest and fruit trees. The author outlines the characteristic features of the Dicercini (Poecilonotini) and Capnodini (Psilopterini) and discusses the ecology of the species *Lampra bella* Cast., *L. decipiens* Mnnh., *L. pretiosa* Mnnh., *L. suvorovi* Obenb., *L. tschitscherini* Sem., and *L. virgata* Motsch. Elm, Oak and Lime are among the tree species most frequently attacked by beetles of this genus. *Ulmus japonica* is a common host of *L. suvorovi*, a species which may attack other trees also, e.g. *Quercus mongolica*, but only if they are in the vicinity of Elms.

13.15 : 13.2. (66.7) : 12.19. MORRIS, K. R. S. **A large-scale experiment in the eradication of tsetse (*Glossina palpalis* and *G. tachinoides*).** *Farm and Forest* 5, 1944 (149–56). [169].

Glossina palpalis and *G. tachinoides* have been eradicated from a thousand square miles of territory in the north-west corner of the Gold Coast in four years of work. This has been effected by the application of a specialized clearing method to complete river systems, which form the natural communities of the species. Certain definite plant associations only are removed, giving the method scientific precision and reducing the loss of vegetation, and also the labour, to a minimum. The method further enables the eradication to be permanent, so that the supervision and expense of maintenance are avoided.

Trypanosomiasis admissions at the district hospital (at Lawra) have fallen by 90 per cent. since control measures started. One hundred and sixty sq. miles of land, which had been depopulated by trypanosomiasis during the past 30 years, is being utilized for grazing and farming, and 500 people have settled voluntarily in parts of this area.

Since the river system is the unit for eradication, this form of tsetse control fits in with land planning and agricultural development on the largest scale. No ground is abandoned to the tsetse, but the fly is replaced and kept at bay by a healthy agricultural population.

Figures are given for the cost of the work on the Kumba river, an area of 600 sq. miles, with 250 miles of river and tributary and a population of 33,000; the total sum was £4,460, but most of the work was done in 1941 and 1942 when labour costs were a good deal lower than they are to-day.

The species of trees and shrubs that had to be cleared are *Alchornea cordifolia* Muell. Arg., *Allophylus africanus* P. de Beauv., *Antidesma venosum* Tal., *Berlinia heudelotiana* Baill., *Canthium hispidum* Benth., *Celtis integrifolia* Lam., *Cola laurifolia* Mast., *Combretum acutum* Laws., *Combretum abbreviatum, Cynometra vogelii* Hook., *Dialium guineense* Willd., *Dissomeria crenata*, Benth., *Ficus platyphylla* Del., *Ficus iteophylla* Miq., *Garcinia baikieana* Vesque., *Mimosa asperata* Linn., *Morelia senegalensis, Paullinia pinnata* Linn., *Pterocarpus santalinoides* L'Hér., *Quisqualis indica* Linn., *Raphia vinifera* P. Beauv., *Salix ledermannii* Seemen., *Sesbania punctata* DC., *Syzygium guineense* DC., *Vernonia amygdalina*

Del., *Vitex chrysocarpa* Planch. This list holds good for fly-belt throughout the northern savanna zone where mean annual rainfall is below 55 in. and the relative humidity falls below 55 per cent. for 6 months of the year. It is probable that other species enter into dry season tsetse habitat in the coastal savanna, and this problem is under investigation.

An appendix to the article gives notes on clearing technique.

13.15 : 13.2. WACHS, H. Die Flugzeit der Nonne in Sachsen in den Jahren 1937–1942. **[The flight period of the nun moth in Saxony in the years 1937–1942.]** *Thar. forstl. Jb.* 93, 1942 (681–7). [G.] [Forschungsstelle für Nonnenbekämpfung, Tharandt.] [170].

Data are given on the relative abundance of nun moths at the winged stage at various periods as evidenced by the number of winged insects caught or trapped during the months June to September of each year from 1937 to 1942, inclusive, in five districts in Saxony.

13.19 : 13.2 (42.1–8). ALLEN, A. A. **A note on *Aromia moschata* L. (Col., Cerambycidae).** *Ent. mon. Mag.* 81, 1945 (37).

13.19 : 13.2 (42.1–8) : 12.26–8. DUFFY, E. A. J. **Observations on *Aromia moschata* L. (Col., Cerambycidae).** With notes by A. M. Massee and J. A. Stephens. *Ent. mon. Mag.* 81, 1945 (87–8).

13.19 : 13.2 (42.1–8). MASSEE, A. M. ***Aromia moschata* L. (Col. Cerambycidae).** *Ent. mon. Mag.* 81, 1945 (88).

13.19 : 13.2 : (42.1–8). STEPHENS, J. A. ***Aromia moschata* L. (Col. Cerambycidae) associated with sound Willows in Kent.** *Ent. mon. Mag.* 81, 1945 (88). [171].

Notes are given on the occurrence and distribution of the Willow-feeding Longicorn *Aromia moschata* in England.

13.2. *Special (Systematic) Zoology*

13.2 : 45.3 : 12.26–8. SYLVÉN, E. Die Biologie des Buchenspinners *Dasychira pudibunda* L. **[The biology of *Dasychira pudibunda* L.]** *Z. angew. Ent.* 30 (1), 1943 (119–42). [G.] R.A.E. 33A (18). [172].

A detailed account is given of all stages of *D. pudibunda*, which was very numerous during 1941–42 in forests in the Schonen province of Sweden, particularly on Beech, and data are given on larval and pupal parasites that were found.

Mature Beech suffered first, the infestation then spread to the surrounding vegetation, and later the ground was strewn with the bodies of starved larvae.

Even in heavy infestations, defoliation did not occur until the end of the season and the Beech nuts were therefore normal, though they were lighter than usual, but defoliation affected the development of young shoots and the flow of sap, resulting in pale-coloured leaves and tough wood, which made the trees difficult to fell in the following year; it is possible that young trees may succumb to repeated attacks.

13.2 (410) : 13.19. BENSON, R. B. ***Urocerus californicus* (Norton) and some other interesting Siricidae (Hym., Symphyta) in Britain.** *Ent. mon. Mag.* 81, 1945 (67–8). [173].

Urocerus californicus has not previously been recorded in Britain. Recently, a single dead female specimen and two living larvae, neither full grown, were found in a sample of Noble Fir (*Abies nobilis*) wood. The natural distribution of this wood wasp is from Vancouver Island south along the coast to the coastal mountains of northern California and along the Sierras to Tulare County, south along the Rockies through Idaho, Utah and Colorado to New Mexico, Arizona and Mexico. The recorded host trees known to the author are *Pseudotsuga taxifolia*, *Abies* spp. and occasionally *Pinus contorta*.

Evidence has now been recorded that *Sirex juvencus* L. occurs in North America as well as in Newfoundland and Labrador.

2. SILVICULTURE

2 : 07.2 (54). LAURIE, M. V. **[The organization of silvicultural research.] Report on action taken on the resolution passed at the 1934 Conference. With summary of debate.** *Proc. 5th silvic. Conf., Dehra Dun, 1939, Item* No. 1, 1941 (42–8, 48–52). [174].

The resolution discussed in this report deals with the co-ordination of research as between provinces in India. Co-operative investigations being carried out include those on Teak seed origin, Bamboo management, and statistical research in irregular crops. Subjects

suggested for such research include introduction of exotics, Teak regeneration, thinning of important species, economic fire control, Sandal regeneration, improvement of forest grazing, reafforestation of derelict forest ground, eradication of climbers.

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

21.3. *Soil Requirements*

21.3 : 23.27 : 42.5. CHADWICK, L. C. **Diagnosis of nutritional requirements of ornamental plants.** *Proc. 19th nat. Shade Tree Conf.* 1943 (5–19). [175].

A brief account of nutritional requirements of trees and shrubs, together with notes on, and a key to, the symptoms associated with various nutrient deficiencies.

21.8. *Phenology*

21.8 (410) : 05.3. GUNTON, H. C. **Report on the phenological observations in the British Isles from December, 1943, to November, 1944.** No. 54. *Repr.* of *Suppl.* to *Quart. J. met. Soc.* 71, 1945. pp. PR 31 + dgms. [176].

22. SILVICULTURAL SYSTEMS. FORMS OF STAND

22.2. *Coppice Forest*

22.22 : 12.26–8 : 33.6 : 33.54. DURHAM, C. B. **The Hazel underwood industry.** *Quart. J. For.* 39, 1945 (6–11). [177].

Hazel coppice is generally confined to the counties of Hampshire, Wiltshire, Somerset and Dorset, though certain areas are to be found in Oxfordshire, Herefordshire and Gloucestershire. The chief uses of Hazel are for 'wattle and daub' plaster work, sheep hurdles, sheep cages, barrel hoops, crate rods, garden fencing, pea sticks, bean rods, faggots, thatching spars, hedge stakes, and heathers. It has been the custom to work the woods on a regular rotation, the Hazel being cut every 8–10 years and the opportunity being taken after each cut to fell a few Oaks. When gaps appeared, a young tree was planted, or the Hazel stems were layered to thicken the wood.

Details are given of the cutting, storing, prices, etc. of rods for crate-making and hurdles, and it is urged that owners should be encouraged to make all good Hazel coppice available to the market and that young men and ex-Servicemen should be trained in the industry. The notes are being prepared in booklet form at a price of 1*s.* post free, to be obtained from the Estate Office, Herriard Park, Basingstoke.

22.22 : 12.26–8. BASU, S. K. **Coppicing of Sal.** With note by Central Silviculturist. *Indian For.* 71, 1945 (96–7). [178].

An account of the experimental coppicing of a Sal (*Shorea robusta*) plantation formed in 1918 in the Kalimpong Forest Division with the object of producing a good and inexpensive type of fuel on coppice rotation. Results were disappointing, as only 56 stumps out of 211 coppiced. The coppicing power of Sal appears to be more closely correlated with size than with age: it decreases rapidly with increase in size.

22.8. *Silvicultural Description of Forms of Stand*

22.89 : 12.26–8 (44) : 23–4 : 33 : 44.3 : 45.3. Le voyage du Comité des Forêts en Champagne et dans la Haute-Marne. [**The expedition of the Comité des Forêts in Champagne and Haute-Marne.**] *Bull. Com. For. Paris* 11, 1942 (841–926 + plates). [F.] [179].

This report of an excursion made by the Comité des Forêts in May 1939 to the Poplar plantations of the Vitry-le-François and St. Dizier regions and the coppice-with-standards of Haute-Marne contains the following papers read on the occasion:—

1. By M. Philippe Guinier, Director of the School of Forestry at Nancy, on different types of Poplar, including hybrids and the various exotic Poplars grown in France, their nomenclature and their utilization.

2. By M. Paul Tardivier on the plantations of the Vitry-le-François district, which cover an area of 20,000 ha. There are estimated to be 1½ million planted trees, between 1 and 30 years old. Since they are usually exploited at 25 years, there is an annual cut of 60,000 trees, which should supply about 90,000 cu. m. of undressed logs to the sawmills and factories. Descriptions are given of nursery and plantation techniques used, the Poplars being propagated from cuttings about 30 cm. long, taken from specially slected trees.

3. By M. Robert Regnier, Director of the Agricultural Zoology Station at Rouen, on the chief enemies of the Poplar, dealing at some

length with various cankers, some caused by bacterial and some by fungous infection; with *Dothichiza populneum*, which causes much damage, especially to weak trees, but is easy to combat by simply cutting and burning all affected branches and twigs; with wood-boring insects, including *Compsidea populnea*, *Saperda carcharias*, *Cryptorrhynchus lapathi*, *Trochilium apiforme*, *Sciapteron tabaniforme*, *Cossus cossus*, *Zeuzera pyrina*; defoliating insects, various species of Chrysomelidae and others.

4. By M. le Comte de Cherisay on the cultivation of the Poplar, choice of sites and species, nursery practice, methods of propagation and planting, tending of plantations.

Several members reported excellent results from using Alder as a nurse to Poplar, especially in wet, poorly drained soils. In some cases Poplar and Alder are now regularly planted in alternate rows.

The papers include a note on nursery cultivation of Poplars from the Forest Service at Compiègne.

A description is given of the State forest of La Haie Revant near St. Dizier, which is managed on a rotation of 144 years, divided into 4 periods of 36 years, each corresponding to a periodic block, the first block being almost entirely regenerated, and consisting of saplings or poles; the second block in process of regeneration; the third and fourth blocks already occupied by stands which are subjected to careful thinnings every 12 years. Accounts are given of other similar forests.

Finally there is a paper by Inspector-General Cuif on the disapperance of Oaks from French forests.

22.89 : 23.21 : 12.25–8 (47.2–6) : 23.24. ISACHENKO, Kh. M. Resul'tatȳ opȳta lesnȳkh kul'tur v Muromtsevskom uchebno-opȳtnom lesnichestve, Ivanovskoy oblasti. [**Results of forest plantation experiments in the Muromtsev instructional-experimental forest, Ivanov District.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 2, 1939 (32–55). [Russ.] [180].

This article gives the results of an investigation of mixed plantings 35–40 years old.

In Pine/Birch mixtures planted in alternate rows 1·82 m. apart, the Pine being spaced at 1·0 m. and the Birch at 1·4 m., the latter species caused heavy damage to the Pine, the average survival of the two species at the time of the inspection being 1 Pine and 8 Birch. Birch also caused considerable damage to Spruce in a 1 : 1 mixture of these two species. In a plantation of alternate rows of 1-year-old Pine seedlings and a 1 : 1 mixture of 3-year-old Spruce and Birch wildings, with planting distances of 1·4 m. between rows and 0·7 m. between plants in each row, survival at the age of 35 was Pine 5 per cent., Birch 18 per cent., and Spruce 30 per cent.

On the basis of these findings it is recommended that, where Birch is to be used in mixture with Pine as a protective measure against fire and in reducing the spread of the Pine rust fungus *Trametes radiciperda* Hart. on moist sandy loams and light sandy clays, it should be planted 2–3 years after the Pine, in the proportion of 3 rows of Birch for every 10 rows of Pine, the distance between rows being 1·5 m. On less fertile soils the Birch and Pine may be planted in the proportion of 5 rows of Pine to 2 rows of Birch at an espacement of 2 m. Adding Spruce to Pine/Birch mixtures increases the density of the plantation. Birch planted with Spruce as a protective measure should not exceed 20 per cent. of the mixture.

In various Pine/Spruce plantings the Spruce have been suppressed by the Pine and such mixtures are not recommended; where they are to be used it is suggested that Birch should be included in the mixture.

Various mixtures of Spruce/Pine/Larch, Spruce/Larch, and Larch/Oak/Spruce were examined, the Larch in each case being *Larix decidua*. Results from the first group were not satisfactory while those from the second and third groups were fairly good. On the whole it is not recommended to plant European Larch on sandy and light clayey soils, as growth is unsatisfactory. Mixtures of Pine and Larch give poor results, since in dense plantations the Pine is suppressed by the Larch and in open plantations the Pine develops coarse branches. The following mixtures are recommended: (1) Larch/Birch in alternate rows at 2–2·5 m. and 1 m. between trees in each row. (2) Spruce/Larch in alternate rows at the same spacing except that the distance between the Spruce trees should be 0·7 m. Larch should be planted as 1-year seedlings and Spruce as 3-year seedlings.

22.89 : 12.26–8 (54.8) : 64 : 21.2–3. KADAMBI, K. **Teak plantations in Mysore and their**

site quality. *Indian For.* 71, 1945 (58–62 + plate). [Mysore Forest Service.] [181].

Most of the early plantations of Teak in Mysore were formed on sites adjoining rivers, owing to the once prevalent idea that the proximity of running water was necessary for the successful regeneration of this species. When the silvicultural demands of Teak were studied in more detail it was realized that the failure of some of these early trials was due to inadequate drainage, and new plantation sites were selected wherever soil and drainage were suitable. About 15,000 acres of Teak plantation have been formed in Mysore since 1856, the year in which such operations were begun in the State. Two-thirds of this area has been covered in the last 25 years. In the peak years of Teak planting (1932 to 1934) over 1,000 acres of Teak were planted annually.

Data are given showing the rate of growth of Teak in Mysore as compared with that of the same species on comparable sites in other parts of India. The Mysore site qualities I, II and III correspond roughly to site qualities III/IV, IV and V respectively of the All-India classification. Height growth in the Mysore plantations in the first twenty years is far behind the All-India standard for the first two site classes, while All-India site V Teak is superior to class III of Mysore throughout.

The author reviews the charges commonly levelled against pure Teak plantations and shows that these do not generally apply to the pure Teak plantations of Mysore, possibly owing to the different methods of treatment here employed, namely, the postponement of the date of first thinnings, the maintenance of a denser stand, and the retention of a considerable portion of the natural undergrowth.

22.89 : 12.25 (931) : 47. HOCKING, G. H. **Artificial regeneration of Kahikatea.** *N.Z. J. For.* 5, 1942–44 (59–61). [182].

A brief account of two plantations of *Podocarpus dacrydioides* in New Zealand, one established in 1931 and the other in 1937. On the whole there was a fair survival and the trees made satisfactory growth. The young trees suffered during the first few years from browsing by deer, frost, gales and the mealy bug *Pseudococcus podocarpi*. Later the chief enemies were weeds and particularly the creepers *Calystegia* and *Muehlenbeckia*, which smothered many trees.

23. FORMATION OF STANDS

23 (47.2) : 21. MELEKHOV, I. S. Kontsentrirovannye rubki na severe i bor'ba za vosstanovlenie lesnogo fonda. [**Concentrated fellings in the north and the problems of reafforestation.**] *Lesnaya Prom.* No. 9, 1944 (3–8). [Russ.] [183].

The rapid development of all branches of national economy in the 1930's brought about great changes in the scale and character of the exploitation of Soviet forests. It was during this period that extensive mechanization was first introduced. As a result, there have appeared in the north of Russia during the last 15 years vast areas of concentrated fellings. Even when a limit of 25 ha. was introduced, actual felled areas were often much larger owing to the fact that several adjacent areas might be felled in one year. Where rail transport was available, clear felling was generally practised, but where the timber had to be floated, Larch, and frequently Birch, were left standing. The problem of regeneration in areas of both types is discussed.

The presence of seed trees is the most important factor in natural regeneration. Seed trees of Spruce are more likely to remain windfirm upon removal of the stand if they are situated on deep, well-drained, light soil. Young growth of Spruce is also of primary importance in regeneration, since 75 to 90 per cent. of the young trees 1½ m. or more in height have been found to bear an average of 4 to 13 cones per tree (200 to 12,000 cones per hectare). The most promising young trees occur in places where the earlier canopy has been broken. During logging operations special care should be taken to avoid injuring this young growth.

Soil conditions after fire or clear felling generally favour the regeneration of Birch rather than Spruce. Where young Spruce is present, however, mixed stands of Spruce and Birch may be found. Spruce may also be reintroduced naturally in the course of succession. In cases where Birch has not been felled Spruce regeneration may not occur at all, and vast tracts of Birch forest may result. Spruce sometimes occurs as a pioneer species on clear-felled or burned-over areas where sources of seed are available, provided that the soil is light, well-drained and well-cleaned.

Artificial regeneration will have to be introduced where no natural regeneration is possible.

Pine, Larch, and sometimes Spruce, can be sown by aeroplane where soil conditions are suitable. Where Spruce is sown, advantage should be taken of the shelter provided by young growth of Mountain Ash, Pine and Birch.

23.1. *Natural Regeneration*

23.1 : 12.26–8 (54.2) : 21.11 : 44.1. NAIR, K. N. R. **The problem of Sal regeneration in Mayurbhanj.** *Indian For.* 71, 1945 (127–9). [184].

Experiments in Mayurbhanj indicate that in this area Sal (*Shorea robusta*) regeneration is possible even with an unbroken top canopy, but that Sal seedlings will not tolerate a lower canopy of 10 to 15 ft. from the ground. Weeds are the greatest hindrance to the establishment of young seedlings, particularly climbers such as *Millettia auriculata* and *Combretum decandrum*. Fire by itself is not such a great danger as many consider it to be. The main danger lies in the luxuriant growth of weeds and grasses which follow the fire. Continued fire protection for a period of more than five years is harmful inasmuch as it induces the growth of certain evergreen species which suppress the Sal. *From author's summary.*

23.1 : 12.26–8 (69) : 21.11. MAURITIUS. **Annual report of the Forest Department 1943.** Govt. Printer, Port Louis, Mauritius. 1944. pp. 11. [185].

Heavy regeneration fellings in a climax or pre-climax type of indigenous forest have led to the establishment of adequate crops of *Mimusops maxima* and *Calophyllum inophyllum* var. *tacamaha*. While the principal species in this type are moderately to highly tolerant of shade, seedlings of the two species mentioned above persist and develop well when the canopy is opened (p. 6).

23.1 : 12.26–8 (69) : 24.31. NIGERIA. **Annual report on the Forest Administration of Nigeria for the year 1943.** Govt. Printer, Lagos. 1944. pp. 36. [186].

A fairly heavy seeding of *Triplochiton scleroxylon* occurred in 1943—the first in ten years; the 'Kurmi' forests of Niger Province were affected as well as the rain forests of Benin and Ondo. Subsequently heavy losses in regeneration were caused by a white scale insect.

Experiments were undertaken to encourage regeneration of this species by opening the forest canopy, useless trees of the middle storey being killed by frill-girdling and poisoning. This work was not begun in time to be generally effective, the foliage of the poisoned trees dying back only under the unfavourable conditions of the dry season which also had an adverse effect on the relatively weak seedlings which up to then had developed under heavy shade. Seedlings which had sufficient light at the right time and suffered no abrupt change of conditions with the coming of the dry season developed satisfactorily (pp. 7–8).

23.1 : 12.25 (76.1). WAKELEY, P. C. **Where and how can the Pines be reproduced.** *Sth. Lumberm.* 169 (2125), 1944 (140–5). [187].

In 1940 through 1942, the Department of Horticulture and Forestry of Alabama Polytechnic Institute co-operated with the Southern Forest Experiment Station in a study of Pine reproduction in the Pine and Pine/hardwood types in central Alabama. The study was designed to indicate roughly the extent of understocking, Pine reproduction failure, and hardwood invasion in the forests of central Alabama, to make possible an estimate of hardwood invasion in individual stands, and to show how to obtain Pine reproduction when needed. A total of 445 randomly selected plots, each at least ½ acre in area, were used as a basis for the study. Of these, 47, or about 11 per cent., were found to be adequately stocked. Of the remainder, only 78, or about 20 per cent., were adequately reproduced to Pine. As a result of analysis of conditions on the sample plots the following minimum standards were worked out for the combination of conditions necessary to give reasonable promise of Loblolly and Shortleaf Pine reproduction.

Minimum number of good seed trees per acre:	
(*a*) to be effective in a single good seed year	10
(*b*) to be effective after repeated good seed years	3
Maximum percentage of ground that may lie directly under crowns of trees, Pines and hardwoods combined	60
(Much lower percentages are desirable; 35 per cent. in Pine stands on uncultivated land, 50 per cent. in old field, and 25 per cent. under hardwoods in mixed stands, are safer maximum limits.)	
Maximum percentage of space in understorey that may be occupied by hardwood reproduction or brush	20

Minimum years, after seedfall, without burning	5
Minimum years, after seedfall, with light or no grazing	5
Minimum exposure of mineral soil (as from disturbance of ground during logging)	Slight

23.1 : 12.25 (931) : 22.11. LYSAGHT, J. F. **Regeneration of clear felled Insignis Pine at Whakarewarewa State Forest, Rotorua.** *N.Z. J. For.* 5, 1942–44 (19–26). [188].

Plantations of *Pinus radiata* in the Rotorua district of New Zealand are being clear-felled to an increasing extent, and in Whakarewarewa State Forest some 80 acres per annum have been felled since 1940; the plantations at present being cut were established in 1914 and 1915.

Natural regeneration of *P. radiata* has been found to be very satisfactory, and sample-plot investigations show stockings of from 100 to over 9,000 trees per acre.

From a study of factors affecting regeneration it was found that: (*a*) Climatic factors have little effect on the amount of regeneration except that heavy frosts or unusually dry periods reduce the number of seedlings. (*b*) Burning removes slash and weeds but also destroys seed. (*c*) The presence of slash, deer, insects and fungi has had only a minor effect on regeneration.

23.1–2 : 12.25 (931) : 21 : 22.11 : 24. JONES, O. **Some re-establishment problems.** *N.Z. J. For.* 5, 1942–44 (9–19). [189].

This article discusses the three major problems of regeneration, species and tending, involved in the re-establishment of forest in the Rotorua district of New Zealand where the felling and utilization of *Pinus radiata* has been taking place on a considerable scale. It is concluded that, despite difficulties, natural regeneration should be the ultimate aim, filling in the gaps and thinning the over-dense patches as soon as possible.

Pinus radiata is likely to continue as the main species used, being replaced by *P. ponderosa* on sites subject to frost damage. Information is scanty as to timber qualities of species other than *P. radiata* grown under New Zealand conditions; they mostly require longer rotations, so that a marked superiority of timber is required to make their growing attractive.

The tending to be given to stands may influence re-establishment methods; the present high proportion of low-grade material might be reduced by thinning, or by wider spacing and pruning. The possibilities and difficulties of these operations are discussed.

23.2. *Artificial Regeneration*

23.21. Choice of Species

23.21 (410) : 22.22. HILLIER, E. L. **Suggested combinations for forestry planting.** 1944. pp. 8. [Institute of Landscape Architects, Winchester.] [190].

The annotated list of suggested combinations of forest tree species is divided into three sections: (1) fast-growing trees for quick returns; (2) slower-growing trees; and (3) coppicing. In the first section are included mixtures in which one of the following species is destined to form the final crop: Sitka Spruce, Monterey Bay Cypress (*Cupressus macrocarpa*), Grey Poplar, Douglas Fir, Giant Silver Fir (*Abies grandis*), Canadian Red Cedar (*Thuja plicata*), Atlantic Cedar, Corsican Pine. Final crop species included in the slower-growing mixtures are Black Walnut (*Juglans nigra*), Scots Pine, Common Spruce, Sycamore, Ash, Oak, Mountain Pine (*Pinus montana uncinata*), White Spruce (*Picea alba*) and Insignis Pine (*Pinus radiata*). Hazel, Ash and Birch are among the most valuable coppice species.

23.21 : 12.25 (410) : 23.24 : 22.1–2 : 23.27. HILLIER, E. L. **Notes on the future of conifers with hardwoods in the British landscape.** 1943. pp. 8. [191].

Practical suggestions are made on the choice of tree species for planting in hilly districts (including chalk hills and reclaimed peat bogs) with particular emphasis on the desirability of mixing coniferous and hardwood trees (e.g. Scots Pine and Beech). A section is included on the spacing of forest trees, and notes are given on the even-aged system of management, on conversion of coppice to high forest, and on the selection system. Suitable species are suggested for planting in open country, in old-fashioned villages, in manufacturing and congested areas, and in maritime districts. There are also short lists of shrubs suitable for seaside planting, and of conifers suitable for parks and gardens.

23.21 : 12.25–8 (41.5) : 23.24 : 21.64. EIRE. **Report of the Minister for Lands on forestry for the period from 1st April,**

1938, to 31st March, 1943. Stationery Office, Dublin. [1944?]. pp. 65. [192].

The tree species more commonly used in State plantations in Eire, with the percentage used in 1942–43 shown in brackets, are Scots Pine (26½), Norway Spruce (17¼), other Pines (16), Sitka Spruce (14⅜), Beech (6½), Japanese Larch (5¼) and European Larch (4½) (p. 22).

Broadleaved species, including Beech, Oak, Ash and Elm, are usually planted on strong soils where their growth may be severely checked by heavy grass vegetation; under these conditions the planting of Beech on thin upturned turfs has proved satisfactory, and the moderate pruning of hardwoods has been successful in promoting height growth on such sites (p. 24).

While Scots Pine is the most useful of the Pines, it is badly defoliated by exposure at high elevations; damage is most severe while the trees are young though not in the first few years after planting. Corsican Pine (*Pinus laricio*) and *P. contorta* are more resistant to exposure and the latter species shows particular promise for use on the less fertile, exposed sites. Scots Pine on the medium heavy soils and Corsican Pine on limestone sites show promise as nurses to broadleaved species (p. 25).

Sitka Spruce has been severely defoliated by aphis, particularly in the last two years, and has also shown severe check on certain areas of heather ground and undrained land. Although Norway Spruce stays in check for a number of years on heavy grass and on heather ground, in most cases it ultimately develops satisfactorily; this species suffers little from disease (pp. 25–6).

Japanese Larch has been gaining in favour over European Larch owing to its successful growth at higher elevations under exposed conditions and against strong competition. Both species tend to suffer from early autumn frosts owing to their failure to ripen off. Larch canker is practically absent from the plantations of the Forest Department (p. 26).

Douglas Fir has shown very poor growth on soils of low fertility and in competition with a heavy grass vegetation, has been severely checked in most districts by attacks of *Adelges*, and on heavy soils has produced a large percentage of crooked coarse stems. More suitable strains of this species are to be used in future (pp. 23, 26).

23.21 : 12.25–8 (46) : 98.1. ECHEVERRIA, I. **Les essences exotiques à croissance rapide dans l'économie forestière espagnole. [Fast-growing exotic tree species in Spanish forest economy.]** *Intersylva* 3, 1943 (209–21). [F.g.e.span.f.it.] M.E.W. [193].

From the forestry point of view Spain may be divided into two vegetation zones having marked differences in climate: (1) a belt in the northern part of the country with a mild, moist climate and bearing central-European flora; (2) the rest of the country, which is characterized by extremes of temperature, little atmospheric precipitation, dry summers, and a Mediterranean flora. The first of these zones, particularly the northern coastal region between the frontiers of France and Portugal, comprising some 700,000 ha., is best suited to the planting of fast-growing exotic tree species. A quarter of this area is already covered with plantations of *Pinus pinaster*, some *P. radiata* and *Eucalyptus globulus*, and species of *Quercus*, *Fraxinus*, *Acacia* and *Eucalyptus* have been planted experimentally to replace the indigenous Oaks and Chestnuts which have suffered heavily from disease.

Details of establishment techniques and the results obtained from these plantings are given in this paper. The author suggests that intensive afforestation by the State, other public bodies and private owners will make possible a considerable reduction in Spain's wood imports, particularly if fast-growing species are used on a short rotation of 20 years or so.

23.21 : 23.23–6 (47.2–6) : 12.25–8. YABLOKOV, A. S., ISACHENKO, Kh. M., D'YACHENKO, A. E., and AL'BENSKI, A. V. Lesnȳe kul'turȳ novȳkh porod. **[Forest cultures of new species.]** Moskovskoe Oblastnoe Nauchnoe Inzhenernotekhnicheskoe Obshchestvo Lesnoy Lesokhimicheskoy Promȳshlennosti. 1938. pp. 123. [Russ.] [194].

This booklet deals with various problems in establishing exotic tree species in the southern portions of the forest zone in the U.S.S.R., which lies between lat. 52·8° and 58·5° N., and long. 30° and 47° E., and includes the Provinces of Smolensk, Kalinin, Moscow, Yaroslav, Ivanovsk, Orlov, Tula, Ryazan and Gorki. It is mainly a review of the relevant American, European and Russian literature.

The two chapters contributed by Kh. M. Isachenko outline the natural history and climatic relationships of the zone as a basis for selecting suitable fast-growing and valuable species of trees and shrubs for introduction.

This is followed by a brief account of conditions in the forest regions of North America, North Asia and Manchuria, with notes on their trees and shrubs. Species from these regions and Central Europe are recommended for introduction.

Two chapters by A. E. D'yachenko deal with (1) the storage and treatment of seed, nursery practice and vegetative propagation, and (2) the establishment and tending of the selected species in forest stands.

A. V. Al'benski discusses some typical methods of planting that have been used successfully in North America and Europe, and also refers to some Russian experimental work on which the following notes are based:—

(*a*) Shrubs such as *Caragana*, *Sambucus*, *Lespedeza* and other species that enrich the soil, may usefully be planted in alternate rows with Larch on sandy soils.

(*b*) On more productive soils Larch may be planted in alternate rows with shade-bearers such as *Picea*, *Pseudotsuga*, *Tilia* and *Juglans*.

(*c*) On relatively dry sites Larch and other species such as *Picea*, *Pseudotsuga*, *Betula* and *Fraxinus americana* may be planted in 1 : 1 mixtures with shrubs in alternate rows.

(*d*) A hardwood mixture that is recommended consists of alternate rows of (*a*) a 1 : 1 : 1 mixture of *Phellodendron*, *Corylus* and *Euonymus* (the two latter may be replaced by *Tilia*, *Acer platanoides*, *Fraxinus lanceolata* and similar species), and (*b*) pure *Corylus*. The species in row (*a*) should be staggered in succeeding rows. *Phellodendron* introduced into the European part of Russia suffers from spring frost but soon recovers.

A. S. Yablokov deals with the establishment of plantations of exotics for purposes of seed production, a necessary preliminary to large-scale planting of the introduced species. Suggestions are made on methods of selecting seed-bearers and on the certification of selected stock.

23.21 : 23.23–6 : 12.25–8 (47.2–6). AL'BENSKI, A. V., and D'YACHENKO, A. E. Razvedenie bystrorastushchikh i tsennykh derov'ev i kustarnikov. **[Cultivation of fast-growing and valuable trees and shrubs.]** Gosudarstvennoe Izadatel'stvo Sovkhoznoy i Kolkhoznoy Literaturȳ 'Sel'khozgiz' Moskva. 1940. pp. 223. [Russ.] [195].

The cultivation of exotic trees and shrubs has been carried out on a large scale in the U.S.S.R., and the number of introduced forms has been greatly increased in recent years. Detailed information on these species is lacking in some cases, or is brief, disconnected and scattered; on the other hand, a great deal of experimental material has been collected but is mainly unpublished. This book is the first effort to bring together the results of experimental work and to review the literature on the cultivation of introduced exotic species. The forests of the various geographical regions of the U.S.S.R. differ greatly in composition. The number of different forms is considerably less in the northern forests than in the south, and considerably greater in the western forests than in the east. The quality and volume of wood and wood products obtained from different regions varies widely, this depending not only on soil and climatic conditions but also on the biological qualities of the species. Large areas are forested with trees that are slow-growing and of small economic value. In order to improve these conditions forests of unsuitable species have been felled, the areas cleared and reforested with more valuable types. Where it is desired to establish forests for particular purposes, such as giving shelter to agricultural land, preventing erosion, fixing sand dunes, protecting water catchment areas, afforesting steppes, etc., great care is taken in the selection of species. Although careful consideration is given to the natural habitat of the introduced species, it has been shown that many species, e.g. of *Pinus*, *Ulmus*, *Acer*, *Amelanchier*, etc., can be propagated and grown successfully in localities previously considered unsuitable, the natural range of such species often being limited only by unpassable barriers such as mountain ranges and steppes.

The book is divided into five chapters as follows:—

1. *The need for cultivating new species in the U.S.S.R.*

2. *Biological characteristics, economic significance and adaptability of individual species.* Notes are given on each of the introduced species, indicating their characteristics, natural habitat, utilization value, method of propagation and cultivation as exotics.

3. *Seed and its treatment prior to sowing.* Data are given on seed source, periodicity and size of seed crops, times and methods of collecting and cleaning seed, weight and testing of seed, seed storage, preparing seed for sowing.

4. *Raising of planting stock.* Deals with time of sowing, care and cultivation of seedlings, and vegetative propagation with reference to various types of cuttings and methods of rooting.

5. *Cultivation of plantations.* A brief account is given of methods of establishing and tending plantations of trees and shrubs.

23.21 : 12.26–8 (62.4) : 11.48.2–3 : 21.2–3. SMITH, J. **Species for dry areas.** *Indian For.* 71, 1945 (85–7). [196].

Data are given on the growth of *Prosopis juliflora* on sites ranging from coarse gravel to fine sand and clay in the Anglo-Egyptian Sudan. Best results were obtained at Khartoum on a low sand dune with an average rainfall of 6 in. Even 24 in. of rainfall did not enable this species to grow on certain clay soils. The clay/rainfall relationship of several species (*Khaya senegalensis*, *Acacia seyal*, *A. mellifera*, *Combretum* sp. and *Hartmannianum* sp.) is indicated. *Acacia arabica* on clay sites has shown a decrease in growth with increased clay content. The ability of *Parkinsonia aculeata* to tolerate long flooding on very stiff soils suggests that it may be worth trying on fine-grained dunes.

23.21 : 12.25–8 (66.9). NIGERIA. **Annual report on the Forest Administration of Nigeria for the year 1943**. Govt. Printer, Lagos. 1944. pp. 36. [197].

Species of *Eucalyptus*, particularly *E. rostrata* and *E. robusta*, are considered to be far more satisfactory as plantation trees than *Callitris glauca*, which in the past has been a favourite species for this purpose in the Northern Provinces but has been found to have many drawbacks: it is slow growing, difficult to handle, does not coppice, has a low yield of fuel, does not easily kill out grass, and has not much value as a soil improver (p. 10).

23.21 : 12.25 (67.6) : 23.24 : 24.2 : 24.51 : 57. GRAHAM, R. M. **Notes on the growing of Cypress timber on farms.** *E. Afr. agric. J.* 10 (3), 1945 (132–9). [198].

Species of *Cupressus* have been grown fairly extensively in Kenya for more than twenty years. They are usually easy to raise in nurseries and plantations, and appear to thrive over a fairly wide range of conditions. The author discusses the general principles underlying the cultivation of *Cupressus*, the choice of species, espacement, the system of planting mixtures, group planting, pruning, and thinning. Yields of timber vary with the quality of the soil and the health of the plantation, the amount of thinning that has been done, and the length of the rotation. The yield from an average well-managed plantation on good land will probably exceed 4,500 cu. ft. per acre from the final crop. Thinnings from the age of 14 onwards will yield about 2,500 cu. ft. per acre.

23.22. Preparatory Work. Auxiliary Measures

23.22.2. *Regeneration in Combination with Agriculture*

23.22.2 (66.9). NIGERIA. **Annual report on the Forest Administration of Nigeria for the year 1943.** Govt. Printer, Lagos. 1944. pp. 36. [199].

It appears that *taungya* is less capable of wide application in Nigeria as a means of regenerating the forest than was originally supposed. This is due to (1) the comparatively few farmers available in the heavy forest, (2) the difficulty of directing the native farmer to the area he will farm in any year, (3) the difficulty in persuading the farmers to do more than clear the area and tend the planted seedlings to a very limited extent. This method is therefore limited to a number of small and scattered series, one for each village, its real practical value being confined to areas of secondary and exploited bush which cannot be regenerated by any more natural means. In Benin the *taungya* technique has been altered from complete cleaning of all natural woody vegetation to the practice of preserving all erect woody growth except *Musanga* in order to establish a forest character in the crop as early as possible (p. 10).

23.23. Sowings

23.23.1. *Seed Treatment and Testing*

23.23.13 (485). SJÖSTRÖM, H. Om frökläng-ningens organisation och teknik. [**On the organization and technique of seed extraction.**] *Skogen* 31, 1944 (361–3). [Sw.] [200].

A small portable seed-extractor of a new type has been manufactured by a Swedish firm. The apparatus, which is electrically operated, has an estimated capacity of 1 hl. of Pine cones per 8 hours. The total weight is approximately 450 kg. This unit is not yet in general use, but has given good experimental results. The extraction of Pine cones in the spring of

1944, partly in the new apparatus and partly in sunlight, gave approximately the same results as regards percentage of germination.

23.23.15 : 12.26–8. WASTNEY, A. W. **Stratification of Beech (*Nothofagus*) seed.** *N.Z. J. For.* 5, 1942–44 (58–9). [201].

A packing case is placed out of doors, at least 4 in. off the ground. Old sacking thoroughly soaked in water is then placed in the bottom of the case and covered with 4 in. of moist river sand. Alternate layers, 2 in. deep, of seed with capsules and sand are then placed in the case with a final layer of 4 in. of sand and a sheet of iron. This is left undisturbed for 2 months (April–May). If, after a few weeks, the top layer shows signs of mildew, the seed and sand must be thoroughly mixed except for the bottom 4 in. The seed can then be left for a few weeks and then thoroughly mixed again, making sure there is still sufficient moisture in the sand. In Nelson the first signs of germination usually appear about September; during August the seed is put through a sieve to remove most of the capsules, and is then again mixed with sand and kept until required for sowing. The most convenient depth for storage cases is about 20 in.

23.23.19 : 21.9. CROCKER, W. **Longevity of seeds.** *J. N.Y. bot. Gdn.* 46, 1945 (26–35, 48). [202].

A review of available data on the longevity of seeds and on the moisture and temperature conditions most conducive to long life. Seeds vary greatly in the length of time during which they retain viability and in the degree of desiccation they can endure without injury. In general, low, constant moisture and low oxygen pressure are the essentials of good storage conditions. These conditions are more easily obtained in the case of hard-coated seeds, many of which show great longevity. Among the trees mentioned in the article are Maple, Chestnut, Hickory, Walnut, Poplar, Willow, *Hevea* and Elm, all of which have seeds of relatively short life duration. Seeds of *Cassia bicapsularis*, *C. multijuga*, and *Albizzia julibrissin*, on the other hand, have germinated after being stored for well over a century.

23.23.19 : 12.26–8 : 23.23.3 : 45.3. GRIFFITH, A. L. **Germination of *Prosopis juliflora*.** *Indian For.* 71, 1945 (17–9). [Forest Research Institute, Dehra Dun.] [203].

Experiments have recently been carried out in connexion with the germination of *Prosopis juliflora*, and a table of results is given. Although all the seed sown were attacked by insects, 10 to 50 per cent. germination was obtained in 5 to 60 days, and the usual low germination appears to be due to other causes. Methods of sowing and pre-sowing treatment are described in detail. Recommendations are made for the control of attacks by species of Bruchidae.

23.23.19 : 12.26–8 (54.8). GRIFFITH, A. L. **Germination of *Prosopis juliflora*.** *Indian For.* 71, 1945 (129). [Forest Research Institute, Dehra Dun.] [204].

A report of very encouraging results obtained with the Mexican and Australian varieties of *Prosopis juliflora* on both sandy and non-sandy soils in the Anantapur Division, Madras.

23.23.3. *Methods of Sowing*

23.23.3 : 12.26–8 : 23.26.1. HEDEMANN-GADE, E. Sådd av björkfrö i plantskolor. **[Sowing of Birch seed in nurseries.]** *Skogen* 32, 1945 (40). [Sw.] [205].

From experiments made over a period of 4–5 years in a nursery near Östhammar the following method has been evolved which gives satisfactory results:—A seedbed is prepared in the usual way and lightly rolled; a mixture of wood ash and soil is spread over the seedbed to a thickness of at least 1 cm. and is then watered thoroughly by sprinkler for 2–3 hours (corresponding to 50–60 cm. rainfall); the bed is then rolled and afterwards raked, and the Birch seed is sown broadcast to give a distance of 1–2 mm. between seeds; a thin layer of soil is spread over the seed, and the bed is then covered with Spruce needles and rolled. Watering is done 3 times a day, at least 15 l. of water per 10 sq. m. of seedbed being applied each time. The seedlings appear after 8–10 days and are watered once or twice a day until the leaves have developed.

The nursery where this experiment was made has a light sandy soil and an open situation.

23.23.3 : 12.25. MCCULLOCH, W. F. **Direct seeding of Douglas Fir in the Tillamook Burn.** *J. For.* 43, 1945 (37–8). [206].

In 1939 a number of plots were set out with the purpose of investigating the possibility and cost of direct seeding of this large denuded area, which was burned in 1933 and again just before the experiment. No living plants remained,

organic material had practically disappeared, and mineral soil was everywhere exposed except where covered with charcoal. Plots were deliberately chosen under the most adverse conditions, representing four different aspects. The plots were sown broadcast and the soil stirred to cover the seed; in each aspect there were four plots, sown respectively with 1, 2, 3 and 4 lb. of seed per acre. Two additional plots were sown broadcast and left uncovered. Examinations in February 1944, showed that there were only 3 seedlings on these two plots, although they were on the most favourable site of all. Of the other plots, mortality was highest on those with a south-west aspect, which receive the full impact of the sun in the hottest part of the day. With this exception, the plots sown at the rate of 1 lb. to the acre are now adequately stocked according to industrial forestry standards. All the seedlings are above 6 in. in height and some are over 3 ft. high. It was expected that increasing the amount of seed would proportionately increase the number of seedlings. The fact that this did not occur is explicable on the ground that greater concentration of seed provides a greater attraction for rodents. The influence of shade alone is shown by the fact that dead seedlings were found on the south side of logs, live ones on the north side. Control of rodents is both practicable and economical, and the favourable placements of seed may be effectively accomplished by the direct seeding gun. [See next abstract.]

23.23.3 : 07.7. Woods, J. B. **The direct-seeding gun.** *J. For.* 43, 1945 (39–40). [Oregon State Forestry Dept., Salem, Ore.] [207].

Early attempts to obtain natural regeneration in burnt-over areas in northwest United States were a failure. Examination of natural regeneration, however, leads to the belief that direct seeding may be successful if rodent control is established and if seeds are planted in spots where soil and cover conditions are conducive to germination and survival. To accomplish the latter object, the Oregon State Forest Department has developed a corn-planter type of seeding gun, which is described in this article. Field tests have been encouraging. Seeding can be done quickly, one man covering 2 to 3 acres a day, according to ground conditions. The seeding gun has been found practical in dense bracken, in dense salal and Oregon grape, in slash and in rocky soil; it operates satisfactorily in wet weather, is light and easily operated and yet strong enough to stand rough treatment.

23.24. Formation of Stands by Planting

23.24 (54.5) : 38.63 : 23.21–2 : 23.6 : 24.2 : 63 : 76.3–4. Kitchingman, G. D. **The Punjab irrigated plantations.** *Emp. For. J.* 23, 1944 (115–21 + plates). [Forest Department, Punjab.] [208].

The Punjab desert tract is a vast alluvial plain having a light-coloured loamy soil interspersed with areas that are highly saline ('kallar' areas). The climate is very arid, annual rainfall varying from 4 in. in the south to 20 in. in the north, and there is a wide temperature range, the mean temperature in the hottest month being above 90° F., while in winter frost is often severe. The natural vegetation is typical of the Indian Northern Thorn forest, consisting mainly of the four species *Prosopis spicigera*, *Salvadora oleoides*, *Capparis aphylla* and *Tamarix articulata*. When irrigated the soil is generally fertile and highly productive.

This paper gives an account of the establishment and management of the irrigated plantations in this tract by which desert waste has been converted into forest land yielding 1¼ tons of firewood and £1 to £1 10s. net revenue per acre each year.

After the main irrigation channels have been constructed the area to be afforested is leased out for 4 or 5 years to cultivators who, in the process of their work, clear it up and level it off. Shisham (*Dalbergia sissoo*) is the principal species planted, commonly in mixture with Mulberry (*Morus alba*) and Bakain (*Melia azedarach*). Planting material consists of stumps—1-year seedlings with root and shoot pruned back, which are planted 6 ft. apart in trenches 10 ft. apart. The plantations require three weedings in the first year and two in the second. Thinnings are made at 6 and 12 years and the coupes are clear-cut at 18–22 years and regenerated by planting.

23.24 (77.3) : 97.2. Davis, J. E. **Forest planting on Illinois farms.** *Circ. Ill. Coll. Agric. Ext. Serv.* No. 567, 1944. pp. 34. [209].

This pamphlet gives advice on the kind of land which can be usefully planted, including

idle land, land subject to destructive erosion, and heavily grazed woodlands; and on the selection of species, methods of planting, costs, and probable financial returns.

23.24 : 07.7. THURN, P. Forstpflanzmaschinen im Osten. [**Forest planting machines in the east.**] *Forstarchiv* 19, 1943 (107–8). [G.] [210].

A brief illustrated description of a Russian machine (type LP1) used in the large-scale planting of Pine.

23.24.1. *Planting Material*

23.24.1 : 12.26–8 : 12.11.21–2 : 23.6 : 23.26. BEREZIN, A. M. K voprosu o kul'ture topoley v Bashkirii. [**On the cultivation of Poplars in the Bashkir Province.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz. 'VNIILKh'* No. 2, 1939 (22–31). [Russ.russ.] [211].

An account is given of experiments in Bashkir, chiefly on the best type of planting stock of *Populus balsamifera* which is said to be the fastest-growing and hardiest of the exotic Poplars in this region. Planting stock included:—(i) unrooted winter cuttings from 1-year-old stems; (ii) 1-year-old rooted cuttings; (iii) 1-year-old seedlings; and (iv) 2-year-old seedlings. Both unrooted cuttings and 1-year-old seedlings showed poor survival and height growth during the first four years after planting; 2-year-old seedlings gave better results, but the best were obtained with 1-year-old rooted cuttings. The differences in survival and growth were most pronounced in dry years.

Further experiments with 1-year-old rooted cuttings indicate that they should be planted out in late October or early spring as a safeguard against drought. A comparison of three plots —one untended and two with different degrees of cultivation and cleaning—showed that by far the best survival and height growth occurred in the plot that was most intensively tended.

Nursery practice for the production of rooted cuttings includes:—preliminary soil cultivation to a depth of 20–30 cm.; selection of cuttings 20 cm. (*P. balsamifera*) to 25 cm. (*P. nigra*) long and not less than 0·5–0·75 cm. in diameter, cut in early spring and planted late in April or early May flush with the soil with a layer 1 cm. deep of sawdust sprinkled with earth to prevent it blowing away. The rooting of cuttings of the local *P. nigra* is said to vary more from year to year and to be more dependent on the quality of the cuttings than is the case with *P. balsamifera*.

23.26. Plant Rearing. Nursery Practice

23.26.1 : 12.26–8 (54.8). **Nursery bed sheltering and shading.** *Indian For.* 71, 1945 (93–5). [Forest Research Institute, Dehra Dun.] [212].

A report of experiments undertaken by the Forest Research Institute, Dehra Dun, to test a technique for determining the relative effectiveness of different methods of sheltering the sensitive species, *Adina cordifolia*, in the nursery. Very little difference was observed between the results obtained with 100 per cent. shades or shelters of thatch and those obtained with 66 per cent. shades or shelters of battens. Shading from the sun before and after the monsoon had a very great effect in increasing the number of survivals, but sheltering from rain during the monsoon period had very little effect. Sheltering during the monsoon combined with shading before and after the monsoon had an effect intermediate between the separate effects. The unshaded, unsheltered controls gave much the poorest survivals. The technique used was, on the whole, suitable for the purpose, but a few minor improvements are suggested.

23.26.3 (74 : 77) : 23.27. **Transplanting of trees and shrubs in the northeastern and north central United States.** *Proc. 19th nat. Shade Tree Conf.* 1943 (70–146). [213].

The subject is dealt with under the headings: selection of plants, season for transplanting, digging operations, loading and hauling, planting, pruning, mulching, guying and staking, maintenance.

23.26.4 : 11.47.12 : 11.44. LANQUIST, K. B. **Leaf litter in forest nurseries.** *J. For.* 43, 1945 (43–44). [U.S. Forest Service, San Francisco, Calif.] [214].

Compost, which has been used extensively in forest nurseries in the Lake States, is considered to be expensive and time-consuming in relation to the benefits obtained, and tests have been made at a nursery in Wisconsin to compare the results obtained with compost and with leaf litter applied direct.

Prior to the sowing of Red Pine (*Pinus resinosa*) for the production of 2–0 planting stock, part of the area was treated with 20 cu. yds. of Hemlock/hardwood litter and 46 cu.

yds. of raw peat per acre and the remainder with 16 cu. yds. of compost and 40 cu. yds. of raw peat per acre. The area treated with litter and peat produced larger, more vigorous and better coloured seedlings than did the area treated with compost and peat, and cull from the former amounted to less than 1 per cent. compared with 3–4 per cent. for the latter.

Fall-sown Red Pine seed covered with 2 mm. of litter was 8–10 days later in germinating but at the end of the growing season the seedlings were superior both in size and quality to those sown and covered in the usual way. The delay in germination, which takes place even when high temperatures occur in early spring, may be important in saving many seedlings from killing frosts which often occur in northern nurseries at the time of germination.

The Hemlock/hardwood litter, which was used because of its availability, contains 0·52 per cent. total nitrogen; that collected under Aspen stands has a higher nitrogen content.

23.27. Arboriculture

23.27 (54) : 23.21. WARD, F. K. **Street trees in India.** *Gdnr's Chron.* 117, 1945 (126–7). O.B.D. [215].

Although the great trunk roads of India are usually well planted with avenues of shade-bearing trees, little attention has generally been paid to street planting in towns. At present certain trees are more or less standardized for street planting all over India, and the results have been far from satisfactory. The author lists some of the qualities desirable in a street tree and names some of the species commonly used in India for that purpose.

23.27 (75 : 76) : 12.25–8. NEWINS, H. S. **Arboriculture in the South.** *Proc. 19th nat. Shade Tree Conf.* 1943 (26–30). [216].

A short account of the work of the southern Shade Tree Conference in arousing public interest in the Southern States in arboriculture. A few notes on southern species are included. The largest single Pine tree of the South is the Loblolly Pine (*Pinus taeda*) growing near Carmichael, Maryland, with a circumference of 16 ft. 7 in. at 4½ ft. from the ground, a spread of 105 ft. and a height of 84 ft. The largest known Bald Cypress (*Taxodium distichum*) grows near Sanford, Florida, with a circumference of 42 ft. and a height of 126 ft. A Live Oak (*Quercus virginiana*) near Hahnville, Louisiana, according to official measurements is 35 ft. in circumference at 4½ ft., has a spread of 168 ft., and a height of 178 ft. This species has the greatest resistance of all Southern Oaks to disease and insect attack.

23.4. *Formation of Forest by Natural Succession*

23.4 (66.9) : 97.2. NIGERIA. **Annual report on the Forest Administration of Nigeria for the year 1943.** Govt. Printer, Lagos. 1944. pp. 36. [217].

It has been found that if fallow lands, such as those in southern Tiv, are protected from fire, the resultant tree growth would be more effective than the present plantations of exotics in improving soil conditions and weakening the growth of grasses injurious to crops, and would at the same time provide material for house posts, etc. (p. 10).

24. TENDING OF STANDS AND TREES

24.1–3 : 12.25–8 (410) : 22.88.2. BOOTH, H. A. **Natural regeneration: a practical example.** *Quart. J. For.* 39, 1945 (21–4). [218].

An example is given of a naturally grown wood which, although completely neglected in the past, offered some possibilities for the future. Its description and the method of treatment advocated, give an idea of what ought to have been done and what may still be done.

The last crop appears to have been removed 20 to 25 years ago and there are trees of all ages up to 40 years, including Oak, Ash and Beech, with some Sycamore, Birch and Cherry. The objects of management are to encourage the best trees to grow into a crop, as far as possible consisting of the most profitable species. The whole operation comprises the selection of the trees, maintaining soil conditions, obtaining and maintaining a canopy, and thinning. Methods for attaining these objects are indicated. It is pointed out that if rabbits could be exterminated, the work could be carried out at a comparatively small cost.

24.2. *Thinnings*

24.2 : 12.25. LANE POOLE, C. E. **Thinning Monterey Pine in the Australian Capital Territory.** *Leafl. Commonw. For. Bur. Aust.* No. 52. [1943?]. pp. 19 + dgm. [219].

In 1927 two sample plots, each 0·1 acre in

area, were established in a 10-year-old plantation of Monterey Pine (*Pinus radiata*) in the Australian Capital Territory. One plot was thinned in 1929, 1932 and 1934 while from the second (control) plot only dead, dying and windthrown trees were removed. In this bulletin a detailed analysis is given of the effects of the thinnings and a comparison is made between rates of growth in basal area and in volume on the two plots. It is concluded that the slight gain in increment does not offset the cost of the thinning unless the stand can be carried to an age and therefore size which will result in a commensurable gain in value, which seems unlikely.

24.2 : 12.26–8 (489) : 56.04 : 56.05 : 21.61 BORNEBUSCH, C. H. L'éclaircie danoise, son influence sur la forme et l'accroissement en valeur de la forêt de hêtre. **[The Danish system of thinning, its influence on the form and value-increment of Beech forest.]** *Intersylva* 3, 1942 (221–42). [F.g.e.span.f.it.] M.E.W. [220].

The Danish system of very heavy thinning, which has now been practised for nearly a hundred years, is adjusted to the windy climate and genetically unsatisfactory Beech forests of the country. In spite of the length of time during which this type of thinning has been practised, few really comparative studies have been made of its effects, which must therefore be studied in the first place in the existing stands without direct comparison. Important factors to be considered are start and frequency of thinning, number of stems and sectional area, stratification of canopy, preservation of an understorey, variation in the degree of thinning and in the aim of management, and the work of selection. In this paper the author treats in detail the more important of these factors, illustrating his argument by data from Danish experimental plots. Particularly detailed treatment is given to self-pruning of the trunks and increment in volume and value. He concludes that the characteristic intensity of thinning is, under Danish conditions, in most cases economically and silviculturally sound; its execution depends on the genetic quality of the stands and on economic conceptions.

The analysis of available data seems to show that habitual heavy thinning in Beech forest produces no perceptible increase in diameter growth during the first 50 or 60 years, but that, once that age is past, diameter increment is increased by heavy thinning and strongly checked in unthinned stands.

24.25 : 12.26–8 : 31.1. SAVINA, A. V. Vliyanie rubok ukhoda na stroenie drevesinȳ osinȳ. **[Influence of thinnings on the wood structure of Aspen.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* '*VNIILKh*' No. 2, 1939 (56–68). [Russ.russ.] [221].

Investigation has shown that by improving light conditions, thinnings cause an increase in both length and breadth of wood fibres and vessel elements as early as one year after thinning. Though shaded trees of classes IV and Va reacted most strongly, in general the effect was independent of dominance or age. Lengthening of the fibres is clearly advantageous in wood destined for the paper industry. Thinning also increases the amount of thick-walled mechanical tissue and that of water-conducting tissue, thus improving the strength of the wood. The best growth and development of the trees were observed after a number of thinnings.

24.3. *Opening of the Canopy. Release and Improvement Fellings*

24.3 : 12.25 (76) : 56.04. BULL, H. **Growing more wood on fewer trees.** *Sth. Lumberm.* 169 (2129), 1944 (195–8). [222].

In 1933 the Southern Forest Experiment Station in co-operation with the Urania Lumber Co. started a study near Urania, Louisiana, on the effects of improvement cutting in a stand composed mostly of second-growth Loblolly and Shortleaf Pines. The results of the first 10 years are now available. The operations in 1933 comprised girdling to kill large unmerchantable hardwoods, improvement cuttings to cut sawlogs and pulpwood from defective Pines, thinnings for Pine pulpwood to reduce excessive crowding in even-aged groups, harvest cuttings of overmature trees and poor quality mature trees. These cuttings were made in half the stand and the other half was left uncut for comparison. The improvement cuttings netted $6.90 per acre exclusive of stumpage. In the first 10 years following the improvement cuttings, annual net growth of Pine saw-timber has averaged 416 bd. ft. per acre or 12·5 per cent. in the improved stand, and 375 bd. ft. per acre or 7·8 per cent. in the uncut stand. Average annual net growth of Pine pulpwood in small

trees and tops has been 0·45 cord per acre or 7 per cent. in the improved stand and 0·40 cord per acre or 3·9 per cent. in the uncut stand. On the basis of all Pines and all merchantable Pine volume growth, 21 per cent. fewer trees have grown 11 per cent. more wood. Counting only merchantable Pines as of 1933, 42 per cent. fewer trees have grown 11 per cent. more wood. In terms of value the increase is well over 11 per cent., since the lowest grades of wood have been cut in the improved stand but still remain in the uncut stand.

A study of the effects of girdling all hardwoods of more than 9 inches d.b.h. is being made on an adjacent stand. In the course of 10 years the Pines released by this operation, in comparison with those not so released, showed nearly 3 times as much diameter growth, about one-half as many trees dying, and a very much higher pulpwood production.

24.31. AFANASIEV, M. **Eradication of trees and shrubs.** *Misc. Publ. Okla. agric. Exp. Sta.* No. MP–8, 1943. pp. 8. [223].

Brief notes are given on the use and effectiveness of various methods for eradicating trees and shrubs, including mechanical methods—felling, girdling, periodic mowing, grubbing and grazing—and the use of poisons—sodium arsenite, chlorates, ammonium sulphamate, common salt, Diesel oil and kerosene.

24.4. *Shelterbelts. Windbreaks*

24.4 (73) : 91.3 : 11.12 : 11.14 : 11.11.4. BATES, C. G. **Shelterbelt influences. I. General description of studies made.** *J. For.* 43, 1945 (88–92). [Lake States Forest Exp. Sta., St. Paul, Minn.] [224].

Between 1935 and 1938 the Forest Service conducted a number of studies in the States from North Dakota to Texas, to show more clearly the nature of the effects which shelterbelts exert. This article gives a preliminary review of these studies, some of which it is hoped to publish in detail in the near future. The difficulties of wind measurement are discussed, possible units of measurement suggested, and an account given of the study on multiple barriers. The primary question is whether two or more parallel barriers, when one is placed within the usual field of the other, produce more, less, or the same effect as would the same units in separate fields. The answer, within the limits of accuracy it has so far been possible to attain, is that the value of 4 barriers separated respectively by distances of 25, 20 and 30 times their common height, was the same as that of 4 barriers of equal length, height and type acting independently. A more surprising fact is that while these distances are well within the limits of effectiveness of a single barrier, there was no such increase of wind reduction between them as one might expect. Another effect of multiple barriers is the extension in all directions of mild benefits from the large and apparently coherent mass of stilled air. Across the ends of the 4 barriers there was created a new zone 7 to 12 heights in width, which received a small degree of protection.

A somewhat related study sought to establish the orientation of shelterbelts most likely to be effective in each latitude. This will be discussed in a subsequent article.

A third group of studies sought to check any deductions which might be derived from effects on the rate of evaporation, by determining more specifically how this would be reflected in the moisture loss from the soil and the accumulation of moisture in the soil.

Yet another study has shown that properly placed shelterbelts may effect a saving of as much as 40 per cent. on the fuel bill of a farm. It is therefore unwise to remove farmstead groves for use as fuelwood to save coal, since the total consumption of fuel may be increased by any weakening of the protective belt.

24.4 (73) : 91.3 : 11.12. BATES, C. G. **Shelterbelt influences. II. The value of shelterbelts in house-heating.** *J. For.* 43, 1945 (176–96). [Lake States Forest Exp. Sta., St. Paul, Minn.] [225].

A detailed account is given of tests made in 1935 and 1936 in South Dakota, in order to determine the amount of saving in house heating which may be effected by shelterbelts. The data are presented and analysed, and it is shown that a belt giving substantial shelter from the north only, reduces the fuel bill by 25 per cent., while protection from north and west may effect a substantially larger reduction, and all-round protection may effect a saving of 40 per cent. The experimental data have been adjusted to actual heating conditions of the typical farm house and calculations made for wind and temperature conditions which prevail at 4 different latitudes in the Plains regions. Results from this investigation indicate that the removal or thinning of farmstead groves,

sometimes undertaken with a view to saving coal, may in fact result in a much higher total fuel consumption.

24.4 (76.5) : 11.62.11 : 12.26–8 : 23.6 : 97.1. SHULLEY, F. J. **The Arkansas shelterbelt.** *J. For.* 43, 1945 (25–6). [226].

The Arkansas Shelterbelt project is an attempt to control wind erosion over an area of about 400 sq. miles in Mississippi County, Arkansas. Black Locust (*Robinia pseudoacacia*) seedlings are planted 4 ft. apart in single rows along the south and west sides of each 40 acres and in an east and west direction through the middle of the field. Crops are planted in east-west rows. Measurements made in 1943 of some of the plantings are tabulated and show a high rate of height and diameter growth. The effect of cultivating the Locust plantations is shown by the comparison of adjacent plantings made on the same day in 1941; the cultivated plants have a high rate of survival and an average height of 22 ft., while those not cultivated have only fair survival and an average height of 8 ft.

The shelterbelts so far established are effecting some control; less sand is now being moved on the planted fields and crop yields are on the increase. The Arkansas Extension Service plans further planting of Black Locust in neighbouring areas where wind erosion is a serious problem.

3. FOREST UTILIZATION. FOREST TECHNOLOGY.

31. PROPERTIES AND ANATOMY OF WOOD. WOOD RESEARCH

31 : 07.2. RISHELL, C. A. **Research—builder of markets.** *Sth. Lumberm.* 169 (2129), 1944 (131–4). [227].

A general account of the lines of research being pursued at the Timber Engineering Co. Chemical Laboratory at Washington, D.C. The laboratory is chiefly concerned at present with lignin, and is investigating its properties as a chief ingredient of an adhesive, its use in fertilizers, water and gas purifiers, and fuel. Other subjects of research are the impregnating and compregnating of wood, manufacture of plastics from hardwood sawdust and waste, chemical bending of wood, and improvement of Teco connectors; an extensive future programme for research on hardwoods is under consideration.

31 : 33.3 : 34.6. HALL, J. A. **Chemical research and permanent forest industries.** *B.C. Lumberm.* 29 (2), 1945 (88–9). [228].

Two major objectives of forest products research are (1) the profitable utilization of logging and milling waste, and (2) efficient organization of forest products industries, making maximum possible use of labour near point of origin of raw material. The author discusses ways in which chemistry may help in attaining these objectives and mentions some recent developments in the chemical treatment and conversion of wood.

31.0. *General Information on Woods*

31.0 : 12.26–8 (213). RECORD, S. J. **Notes on tropical timbers.** *Trop. Woods* No. 81, 1945 (2–5). [229].

Miscellaneous notes including a brief report on the identification of Demerara Greenheart (*Ocotea rodiaei* (Schomb) Mez.) as the species used for lintels in the Martello Tower on Barbuda, one of the Leeward Islands; a comparison of the wood structure of *Dicymbe heteroxylon* Ducke and *D. amazonica* Ducke; and the occurrence of ray aggregates in certain woods (e.g. *Matayba* sp.).

31.1. *Structure. Anatomy. Identification*

31.1 : 12.26–8 (67.4). RIERA, P. F. Primera contribución al conocimiento de las maderes de la Guinea continental española. **[First contribution to the knowledge of the timbers of continental Spanish Guinea.]** Dirección General de Marruecos y Colonias, Madrid. 1944. pp. 251 + plate. [Span.] [Servicio Forestal de los Territorios Españoles del Golfo de Guinea.] [230].

After an explanatory introduction dealing mainly with the microscopic study of timber and its physico-mechanical qualities, data are given on each of 27 Spanish colonial timbers, including one unidentified species of the Myristicaceae. The following information is

given for each species: family; botanical, vernacular and commercial names; the macroscopic and microscopic characters of the timber; its physical, mechanical and technological properties, and its use. Supplementary information is also given for each species.

31.1 : 01.4. HARLOW, W. M. **The chemical softening of wood for microtome sectioning.** *Tech. Publ. N.Y. St. Coll. For.* No. 63, 1944. pp. 16. [231].

The purpose of this bulletin is to bring together descriptions of all methods used in softening wood tissues for microscopic examination on which data have been found, and to add the results of some experiments by the author. It is concluded that hydrofluoric acid appears to be the best agent for this purpose, though several others can be made to yield satisfactory material of certain woods in a fraction of the time usually considered necessary. Few of these latter reagents, however, are satisfactory when living tissues compose a portion of the block to be sectioned. In such cases hydrofluoric acid, with or without previous treatment of the material in hot alcohol, appears to give the best results.

31.1 : 12.26–8. SHAH, R., and SINGH, T. C. N. **A preliminary note on the application of absorption-spectroscopy to timber wood extracts.** *Curr. Sci.* 13, 1944 (178–9). L.S. [232].

Equal quantities of fine shavings of the woods of *Pterocarpus marsupium*, *Tectona grandis*, *Gmelina arborea* and *Boswellia serrata* were boiled separately in equal volumes of tap water for 15 minutes, subsequently cooled and filtered. The four liquids, together with a sample of tap water as a control, were each subjected to spectroscopic examination, the spectrograph of their absorption spectra being taken in an arc light emitted from iron electrodes. The absorption spectra were shown to be very clear and characteristic for each species, these results being confirmed in a number of subsequent experiments. The study has now been extended to the woods of *Azadirachta indica* and Santra (*Citrus suntara*).

31.1 : 12.25–8 : 01.3. MILANEZ, F. R. Nota sôbre a classificação do parênquima do lenho. **[Note on the classification of wood parenchyma.]** *Rodriguésia* 8 (17), 1944 (1–3 + plates). [Port.] [Secção de Biologia do Serviço Florestal, Rio de Janeiro.] [233].

The following terms and definitions are suggested:—

Apotracheal Parenchyma,

1. Diffuse—in scattered rows between the other elements of the wood.
2. Reticulate—diffuse and in short bands, frequently anastomosing.
3. Tangential—in short, interrupted bands.
4. Regular narrow concentric bands—1–3 cells wide, regularly spaced.
5. Irregular narrow concentric bands—1–3 cells wide, irregularly spaced.
6. Wide concentric—with bands 4 or more cells wide.
7. Terminal or initial—situated at the end or at the beginning of the growth ring.

Paratracheal Parenchyma.

8. Vasicentric—enclosing the vessel entirely; outline oval or circular.
9. Aliform—like 8, but with lateral extensions.
10. Confluent—clearly resulting from more or less complete fusion of 8 and 9.
11. Incomplete—constituting an incomplete sheath to the vessel.
12. Unilateral—like 11, but limited to the abaxial side of the vessel.
13. Winged—like 11 and 12, but with lateral extensions.
14. Winged-confluent—resulting from the fusion of those of the former type.
15. Secretory—containing swollen cells with special contents.
16. 'Peculiar'—not belonging to any of the previous categories.

Mixed Parenchyma.

17. Mixed tangential—like 3, but including vessels.
18. Mixed concentric—like 4, 5, 6, but including numerous vessels.
19. Mixed initial—like 7, but including numerous vessels.
20. Mixed unilateral—like 12, but continuous and apparently *not* resulting from fusion as in No. 14.

Nos. 17 and 18 are new terms intended to cater for bands of parenchyma, which, though apotracheal in type, yet enclose many vessels.

31.1 (213). NORMAND, D. Introduction à l'étude descriptive de bois tropicaux. **[Introduction to the descriptive study of tropical woods.]** Secrétariat d'état aux colonies, Paris. 1942. pp. 26 + plates. [F.] L.C. [234].

This publication is intended to provide the student with an account of the development of the various tissues of the cambium; these include firstly the 'essential' tissues such as vessels, tracheids and parenchyma, and secondly the 'accessory' tissues such as tyloses, intercellular canals, latex tubes, included phloem, etc. A schematic list of headings for use in describing the timber of a hardwood is appended.

31.1 : 12.26–8 : 12.11.23 : 12.14.4. RODRIGUES, A., and ALMEIDA, F. J. DE. Sôbre o desenvolvimento de exostoses e a emissão de raízes nos caules das plantas novas de *Olea europaea* L.). **[On the development of swellings and the production of roots on the stems of young plants of *Olea europaea* L.]** *Agronomia lusitana* 4, 1942 (237–65 + plates). [Port. port.e.] [235].

The article gives an account of research on the primary and secondary structures of branches of *Olea europaea* L. with special reference to the occurrence of branch swellings and to the development of roots on earthed-up stems and branches.

31.1 : 12.26–8 (82). TORTORELLI, L. A. Estudio xilológico del *Drimys winteri*. **[A study of the wood of *Drimys winteri*.]** *Rev. Fac. Agron. B. Aires* 11 (1), 1944 (42–9). [Span. span.e.port.] [236].

A detailed description of the macroscopic and microscopic characters of the heartwood of *Drimys winteri* (var. *chilensis*?) from the Beagle Channel, Tierra del Fuego.

31.2. *Physical Properties*

31.2 : 12.19 : 12.25 (94). **The properties of Australian timbers: Brown Pine and Black Pine (*Podocarpus elata* R. Br. and *P. amara* Bl.)** *Mon. News Lett. Div. For. Prod. Aust.* No. 136, 1945 (6). [237].

31.2 : 12.26–8. BAUDENDISTEL, M. E., and PAUL, B. H. **Southern hard Elms as substitutes for Rock Elm.** *Sth. Lumberm.* 169 (2129), 1944 (211–5). [238].

Results from tests that have been made by the U.S. Forest Products Laboratory indicate that Cedar Elm (*Ulmus crassifolia*) and Winged Elm (*U. alata*) compare favourably with Rock Elm (*U. thomasii*) in specific gravity and shrinkage, and should be suitable as substitutes for this species where strength and toughness are primary considerations. Data on specific gravity and shrinkage from green to oven-dry condition are tabulated for wood samples taken at various heights in trees of the three species from a number of localities.

31.21. Texture. Grain

31.21.33 : 31.27–8. KOEHLER, A. **Guide to determining slope of grain in lumber and veneer.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1585, 1943. pp. 25 + tbls. + figs. P.R. [239].

Slope of grain in lumber refers to the inclination of the fibres usually with respect to the major axis or one of the longitudinal corners in a piece of wood with parallel sides and edges. In veneer, slope of grain is with respect to the faces and edges and applies not only to the inclination of the annual rings but also to that of the fibres in the plane of the annual rings. The principal objections to excessive slope are that it reduces the strength, may cause warping with change in moisture content, and makes it difficult to surface lumber smoothly when planing against the grain. The purpose of the present publication is to provide a comprehensive guide for detecting and measuring slope of grain in lumber and veneer.

31.22. Relation to Water, Air, Gases

31.22.1 : 07.7. DUNLAP, M. E. **Electrical moisture meters for wood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. R1146, (revised) 1944. pp. 5. P.R. [240].

Electrical moisture meters have the advantages of convenience and speed over other methods used for determining the moisture content of wood. They are, therefore, adaptable for sorting lumber and veneers on that basis. Two general types of instrument are available, one evaluating the moisture content by measurement of the electrical resistance and the other by measuring the electrical capacity of the wood. The relative advantages and disadvantages of each type are discusssed. A list of manufacturers of these instruments is appended.

31.22.2 : 33.36.3. **Holes in green timber: how they shrink on drying.** *Mon. News Lett. Div. For. Prod. Aust.* No. 136, 1945 (5). [241].

A simple experiment recently carried out has shown that across the grain, the reduction in diameter of holes during the drying of green

timber is closely in accordance with the normal shrinkage for the species used, and that shrinkage parallel to the grain is almost negligible. Most people using green timber are apt to overlook the fact that holes originally circular will shrink in width and become oval as the timber dries.

31.23. Specific Gravity

31.23 : 33.15. PAUL, B. H., and LINBACH, J. P. **A rapid method of determining the specific gravity of veneer.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1397, 1943. pp. 5 + figs. + chart. P.R. [242].

A sample of veneer is accurately cut to 100 sq. cm. (10·0 × 10·0 cm.) or 50 sq. cm. (7·07 × 7·07 cm.), depending on its thickness which is measured by a micrometer to 0·001 in. The veneer is then attached to a sensitive spring of the type used in a Jolly balance, and a chart is read directly in specific gravity at the current moisture content for the given thickness of veneer employed. Parallel readings for allowable tolerances of thickness are included. *From authors' summary.*

31.27. Mechanical Strength

31.27 : 31.46 : 11.11. TIEMANN, H. D. **What temperature injures wood? (1) Effect of temperature variation on strength. (2) Compression tests of dry wood. (3) Compression tests of frozen wet wood.** *Sth. Lumberm.* 168 (2117), 1944 (55–6); 169 (2119), (53); 169 (2121), (51–2, 54).

31.27 : 11.11 : 31.23. TIEMANN, H. D. **The drying of frozen wet wood and the peculiar relation of density to crushing strength.** *Sth. Lumberm.* 169 (2123), 1944 (55–7).

31.27 : 11.11. TIEMANN, H. D. **Effect of temperature on stiffness. Bending tests on frozen wood.** *Sth. Lumberm.* 169 (2125), 1944 (55–6).

31.27 : 11.11. TIEMANN, H. D. **Effect of temperature on the strength of wood. 6. Impact tests on refrigerated wood in bending.** *Sth. Lumberm.* 169 (2127), 1944 (55–6). [243].

A. The effect of temperature on strength:—

1. *When wood is brought back to normal temperature.*

When wood is re-dried after being subjected to saturated steam or dry air at 212° F. for up to 8 hours, there is no appreciable reduction of strength in compression or in bending, but there is a reduction of from 12 to 20 per cent. in strength when the material is re-soaked. Steaming at higher temperatures causes a reduction in strength even when the material is re-dried. Toughness is reduced, even when the wood is re-dried by temperatures below 212° F. A slow chemical change takes place in the wood substance itself when exposed for very long periods to temperatures even considerably below boiling point, particularly if much moisture is present.

2. *When wood is used or tested at the temperature in question.*

Tension across the grain and stiffness may be reduced to as little as a half and a third, respectively, in wet wood at temperatures below 180° F., a fact of considerable significance in connexion with the checks and shakes caused by the tensions set up in kiln drying.

(*a*) *Compression tests of dry wood*: For dry wood there is a linear relation between temperature and crushing strength for a range of temperature from – 200° to + 160° C., strength decreasing as temperature rises. The rate of change increases with specific gravity. Above 160° C. (320° F.) strength decreases even more rapidly, owing to chemical decomposition.

(*b*) *Compression tests of frozen wet wood*: When wood contains a considerable amount of moisture a different effect is produced at low temperatures. As moisture is increased beyond 40 per cent. moisture content, more and more vessels become solidly filled with ice, thus increasing the crushing strength until a point is reached (at 85 per cent. moisture content) where these frozen columns of ice form a coherent lattice to such an extent that the load is largely supported by the ice itself, the ice lattice being less plastic than the wood. As the load is increased heat is generated by the work done, the ice melts and the strength is again reduced. The relation to density is peculiar. One might expect that, for a light wood such as Balsa, the crushing strength at say – 42° C. would be that of the contained ice plus that of the dried wood, but in fact it is ten times as great. Another anomaly is that the relation between crushing strength and density is not a straight line, as is the case for oven-dry and air-dry wood, but is a parabola and, further, exhibits a sudden drop of about 200 kg./sq. cm. at 0·5 density. The explanation of this drop is thought to be connected with the decreasing number of ice columns as the

density of the wood increases, a limit being reached where a combination of increased stress and heat of compression causes the ice columns to melt; this happens to occur at 0·5 density.

(*c*) *Static bending tests on frozen wood*: Temperatures of between + 20° and – 8° C. have no effect on the relation between elasticity and moisture content, but with lower temperatures the modulus of elasticity increases, provided the wood contains some moisture; when wood is perfectly dry, a change of temperature from + 20° to – 50° C. has practically no effect. The rate of decrease in the modulus of elasticity with increasing moisture content is also affected, the colder the temperature the less does stiffness fall off with increase in moisture. Between freezing and – 8° C. the stiffness of ice is nearly the same as that of wood; ice therefore has no effect on the elastic behaviour of wood. At lower temperatures ice becomes stiffer than wood and the combination of the two results in an increase in stiffness, which is greater the more ice is present. The reason for the different effects of temperature on stiffness and on ultimate strength is thought to be related to the nature of the fine structure of the cell wall.

(*d*) *Impact bending tests on frozen wood*: With increased moisture the 'work' falls off to about 58 per cent. of the value for oven-dried wood. At an average moisture content of 7·5 per cent. this strength value appears to have no relation to the temperature.

B. The drying of frozen wet wood:—

When frozen wet wood dries, the free-water ice cannot move toward the surface and, as some of the hygroscopic moisture is solid, diffusion in the wall must be extremely slow. Drying is thus confined to a narrow zone that moves inwards, vaporization taking place from the edge of the inner ice zone; consequently no shrinkage can occur, provided there is no surface checking. Similarly, there can be no honeycombing. Thus the wood should dry completely *without any shrinkage*, though a long time would be required except for very thin material.

31.27 : 12.25 : 33.91 : 38.1. GEIGER, F. **Mechanical testing and grading of wood for high grade structures.** *Flughafen* 10, 1942 (13–20). [G.] [Ministry of Aircraft Production, *R.T.P. Transl.* No. 1731. pp. 13 + figs.] I.F.B. [244].

In designing wooden structures it is important to have dependable data on the mechanical strength of the timber under static and moving loads and under the prolonged action of constant or alternating load, and also to have information on its resistance to weathering and on other qualities.

An account is given of a series of tests made on samples of Fir (*Abies pectinata*) timber to determine the strength properties of this wood and the effect of various factors such as moisture content, direction of grain and knots on these properties.

The mean strength values for Fir wood, as determined by standard samples of flawless wood, are given as follows:—

	*kg./cm.*²	*g./cm.*³
Compression strength	400	—
Tensile strength	900	—
Bending strength	720	—
Shearing strength	70	—
Dry weight strength	—	0·75
Limit of proportionality	—	333
Modulus of elasticity parallel to the grain	100,000	—
Modulus of elasticity across the grain	3,000	—

Great care must be taken to avoid defects as in selecting wood to be used in supporting structures. The strength of carefully selected Fir will always be sufficient for this purpose.

31.27 : 12.25 : 11.11.2. THUNELL, B. Inverkan av upprepad frysning och upptining i vattenmättat tillstånd på furuvirkes hållfasthetsegenskaper. [**The influence of repeated freezing and thawing on the strength properties of water-saturated Pine wood.**] *Medd. ProvnAnst., Stockh.* No. 82, 1940. pp. 8. [Sw.g.] P.R. [245].

Water-saturated Pine timber was frozen to – 15° C. and thawed in water, the process being repeated 15 times. The bending strength of the timber, its modulus of elasticity in bending, and its resistance to impact bending remained unaltered.

31.27 : 12.25. BROKAW, M. P., and FOSTER, G. W. **Effect of rapid loading and duration of stress on the strength properties of wood tested in compression and flexure.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1518, 1945. pp. 17 + tbls. + figs. P.R. [246].

Tests were made on specimens of Sitka Spruce and Douglas Fir in order to evaluate the effect of rapid loading on the strength of wood in compression or bending, special emphasis being placed on the determination of the time during which compressive or flexural loads could be sustained prior to failure of a loaded member. Reports are given on each of the following tests, the results being summarized in table form: (1) The effect of rapid loading on the strength properties of Sitka Spruce and Douglas Fir tested in compression parallel to grain. (2) The behaviour of Sitka Spruce under sustained compression loads applied parallel to the grain. (3) The effect of rapid loading on the strength properties of Sitka Spruce and Douglas Fir beams. (4) The behaviour of Sitka Spruce beams under sustained loads. (5) The effect of relaxation on the behaviour of Sitka Spruce beams.

Testing procedure and materials and equipment used are described and illustrated by photographs. Definitions are given for a number of new terms that have been developed in connexion with this work and are now added to the nomenclature common to 'duration of stress'.

31.27 : 33.15 : 12.25 : 31.22.1. Drow, J. T. **Effect of moisture on the compressive, bending and shear strengths, and on the toughness of plywood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1519, 1945. (1–12 + plates). P.R. [247].

Results of compression, static bending, shear, and toughness tests of Douglas Fir and Sitka Spruce plywood of several constructions and of matched solid wood at a number of moisture-content values are given in detail. The tests show that the toughness of plywood is less affected by moisture than is that of solid wood, and no significant difference in toughness of plywood was observed over the moisture-content range from 3 to 22 per cent.

31.27 : 12.25–8 (59.6–9 : 67.1–2). Nos bois coloniaux: Deuxième complément à l'étude physique et méchanique des bois coloniaux. [**Our colonial timbers: Second supplement to the physical and mechanical study of colonial timbers.**] Ministère des colonies, Paris. 1944. pp. 20. [F.] L.C. [248].

The physical and mechanical properties of wood specimens are tabulated for 120 French colonial broadleaved and coniferous forest trees. The species are indexed according to vernacular and commercial names as well as scientific names.

31.27 : 12.26–8 (81). Weinbaum, O. **Results of exploration for timber in Para and Amazonas.** Experimental Laboratory of the Companhia Nacional de Navigacion Costeira. [n.d.] [Ministry of Aircraft Production, *R.T.P. Transl.* No. 1043. pp. 9 + figs. + tbl.] I.F.B. [249].

Tests were made on the mechanical properties of a number of Brazilian timbers in order to select a light, strong timber suitable for use in aircraft construction. The results are tabulated and illustrated by diagrams. Sitka Spruce (*Picea sitchensis*) was used as a control species for purposes of comparison.

Of the large number of timbers tested, the following are selected as worth special attention : Freijo (*Cordia goeldiana*) (sp. gr. 0·70) and Louro Amarelo (*Nectandra amazonum*) (sp. gr. 0·56) with high tensile and compressive strength; Genipapo (*Genipa americana*) (sp. gr. 0·77) and Geniparána (*Gustavia augusta*) (sp. gr. 0·83) with a high load factor and a high dynamic bending strength; Assacú (*Hura crepitans*) (sp. gr. 0·48) and Arapary (*Macrolobium acaciaefolium*) (sp. gr. 0·45) with good elastic properties. Resistance to insect attack and humidity, and suitability for gluing, must also be considered in selecting woods for aircraft construction.

31.27 : 12.26–8 : 31.23. Wiepking, C. A., and Doyle, D. V. **Strength and related properties of Balsa and Quipo woods.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1511, 1944. pp. 9 + tbl. + figs. P.R. [250].

A series of tests were made to determine and compare the various strength and related properties of Balsa (*Ochroma lagopus*) and Quipo (*Cavanillesia platanifolia*). The average specific gravity of the two woods was approximately the same—0·13 for Balsa (range 0·06–0·24) and 0·12 for Quipo (range 0·07–0·20); that of Quipo was less variable within individual pieces. The moisture content of Quipo was slightly higher than that of Balsa.

The Balsa was generally bright and free from decay whereas the Quipo was badly stained and decay was present to such an extent that it was necessary to use specimens containing decay for the tests.

Comparing the results obtained from specimens of similar specific gravity the Balsa gave the higher values in static bending, compression

parallel to the grain, and toughness; the Quipo was superior in compression perpendicular to grain when loaded on the tangential face; and the two species were approximately equal in compression perpendicular to grain with load on radial surfaces, tension perpendicular to grain, shear parallel to grain, and hardness.

31.27 : 12.26–8 : 31.8. Luxford, R. F., and Wood, L. W. **Survey of strength and related properties of Yellow-Poplar.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1516, 1944. pp. 17 + tbls. + figs. P.R. [251].

Tests were made on specimens of Yellow Poplar (*Liriodendron tulipifera*) for data on strength and related properties, particularly as affected by colour and stain. Differences in strength among the various colour groups tested were found to be closely related to difference in specific gravity; the more important strength values correlated closely with specific gravity, but much less so with rate of growth.

Toughness tests indicated that Yellow Poplar is some 45 per cent. below Sitka Spruce in this property, and that 55 inch-pounds per specimen ($\frac{5}{8} \times \frac{5}{8} \times 10$ in., 8-in. span, centre loading) is a suitable acceptance value for Yellow Poplar in order to eliminate material that is brash or contains decay and pre-existing compression failures.

31.3. *Chemical Properties*

31.3. **[Reports of committees of the Technical Section, Canadian Pulp and Paper Association.] Report of the Wood Chemistry Committee. With appendix: recent advances in the chemistry of wood,** by F. H. Yorston. *Pulp Paper Mag. Can.* 46, 1945 (274, 276, 278, 280). [252].

In the appendix to this report a survey is made of 33 selected references, covering the 12-month period up to October, 1944, on advances in wood analyses, wood hydrolysis, the chemistry of cellulose, the structure and chemistry of lignin, the characteristics and uses of sulphite waste liquor, and the chemistry and uses of tall oil.

31.3 : 12.26–8. Virasoro, E. **Lignin extracted with acetoacetic ester.** *Anal. Inst. Investig. scient. Technol.* 12–13, 1942–43 (175–86). Brit. Abstr. A II, 1945 (32). P.R. [253].

Extraction of the wood of *Aspidosperma quebracho* Schlecht, with CH_2 Ac. CO_2 Et yields 27·12 per cent. of an ester-lignin, $C_{31}H_{31}O_9$ Ac $(OH)_3$ $(OMe)_4$ containing a CO group. 17·84 per cent. of an ester-lignin was similarly obtained from *Salix humboltiana* Willd.

31.3 : 12.25. Perrenoud, H. Zur Kenntnis der kolloidchemischen Eigenschaften des Humus. Dioxanextraktion und Dispersitätschemie des Fichtenholzlignins. **[The colloid-chemical properties of humus. Dioxan extraction and dispersion chemistry of Spruce lignin.]** *Kolloidzschr.* 107, 1944 (16–41). [G.g.] O.R.S. [254].

A study of the slow oxidation, sorption and dispersion of Spruce lignin, as observed in a typical preparation extracted with dioxan.

31.3. Lovell, E. L. **Viscometric chain length of wood cellulose in Triton F solution.** *Industr. Engng. Chem.* (*Anal. Ed.*) 16, 1944 (683–5). [Central Chemical Laboratory, Rayonier Incorporated, Shelton, Wash.] P.R. [255].

Use of aqueous dimethyldibenzyl-ammonium hydroxide (Triton F) as a cellulose solvent for the determination of average chain length by the viscometric method, in dilute solution, is suggested. A suitable experimental technique is described in detail. Intrinsic viscosity data for a number of cotton and wood celluloses in Triton F are compared with the corresponding degree of polymerization values obtained viscometrically after nitration, and a linear relationship is established. The results are compared with cuprammonium viscosity values, as used in the wood cellulose industry. *Author's summary.*

31.3 : 12.25. Max, K. W. **Chemical analysis of green Loblolly Pine.** *Sth. Pulp Paper J.* 7 (8), 1945 (36). [256].

31.3 (51) 12.25–8. Chia-Tung Chung. **Chemical analysis of Chinese wood.** *J. Chin. chem. Soc.* 9, 1942 (90–2). O.R.S. [257].

Data are given on the moisture, ash, OMe, lignin, and α-, β- and γ-cellulose content of the following 10 Chinese timbers and on their solubility in cold water, hot water, ether, and 1 per cent. NaOH: *Cunninghamia lanceolata, Cupressus funebris, Phoebe nanmu, Pterocarya stenoptera, Betula luminifera, Alnus cremastogyne, Schima crenata, Castanopsis platyacantha, Picea brachyphylla(?)* var. *complanata* and *Pinus massoniana.*

31.3 : 12.25. MANUEL, W. A., and LEWIS, H. F. **Redwood tannin. Use as a depressant for calcite and quartz in the flotation of fluorspar.** *Industr. Engng. Chem.* (*Industr. Ed.*) 36, 1944 (1169–71). [Institute of Paper Chemistry, Appleton, Wis.] P.R. [258].

Redwood tannin recovered from stumpwood, rootwood, twigs and cones was studied as a depressant in the separation of fluorspar from calcite and silica; the results are compared with those obtained with Quebracho. The stumpwood tannin in sodium carbonate solution appears to have as satisfactory an action as does Quebracho tannin; stumpwood tannin in isopropyl alcohol is not quite so satisfactory. Cone tannin is likewise satisfactory. Twig tannin and stumpwood tannin in sodium silicate solution do not appear to clean the calcite as well as the other products. The 'humic acid' from Redwood bark has also been tested. Good cleaning is obtained with low recoveries of calcium fluoride when 0·4 lb. per ton of ore is used; both cleaning and yield are improved with 0·5 lb. Redwood bark 'humic acid' is easily obtained and could be made available in crude form at a low price.

31.4. *Durability. Decomposition*

31.42. Attack by Plant Organisms

31.42.11 (410) : 33.36.1 : 12.21. FINDLAY, W. P. K. **Dry rot in bomb-damaged houses.** *Builder, Lond.* 165 (5253), 1943 (287–8). L.S. [259].

Brief notes are given on five buildings that were more or less badly damaged by bombing in 1940–41 and were subsequently found to be extensively infected with dry rot. Remedial measures are recommended. [Cf. *For. Abstr.* 6 (28).]

31.42.11 : 12.21. HIRT, R. R., and LOWE, J. L. ***Poria microspora* in house timbers.** *Phytopathology* 35, 1945 (217–8). [New York State College of Forestry, Syracuse, New York.] [260].

Poria microspora, a newly-described fungus, was first found on Sitka Spruce in the Queen Charlotte Islands, British Columbia. The extensive but sporadic distribution of the species indicates that it is probably widespread but has so far been overlooked on account of the rare appearance of the fruiting bodies and the confusion of the plant with the more familiar *Trametes serialis*. Serious decay due to *P. microspora* was recently found in a new house in Syracuse, New York. No sporaphores were formed on the decaying timbers but several boards removed from the house and kept under observation at the New York State College of Forestry produced fruiting structures in approximately one year.

31.42.11 : 12.21. ERMILOVA, V. S. Zhiznesposobnost' vnutridrevesnogo mitseliya v vozdushno-sukhoy drevesine. [**Viability of internal mycelia in air-dry wood.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz. 'VNIILKh'* No. 2, 1939 (69–74). [Russ.] [261].

A brief account is given, from Russian literature and unfinished experiments, of the wood-rotting fungi *Poria vaporaria* Fries, *P. vaillantii* Fr., *P. crassa* Carst., and *P. contigua* Fr. Preliminary results indicate that mycelia of *P. vaporaria* and *P. vaillantii* may remain viable in air-dry wood (58 per cent. relative humidity) for 2–2½ years, though in a resting state. It is therefore important during constructional repairs to remove infected wood if possible, and, if not, to apply chemical or constructional means of control.

31.43. Attack by Animal Organisms

31.43 : 12.26–8 (68.9) : 13.2 : 31.41 : 33.36.1. DUFF, C. E. **Termite resistance test on the copperbelt of Northern Rhodesia.** *Emp. For. J.* 23, 1944 (160–2). [Forest Department, Northern Rhodesia.] [262].

A small termite resistance test of timbers from the deciduous woodlands of Northern Rhodesia, started in 1933, has given the following results:—

(1) The species *Baikiaea plurijuga*, *Afrormosia angolensis*, *Amblygonocarpus obtusangulus*, *Entandrophragma caudatum*, *Pterocarpus angolensis*, *Albizzia antunesiana* and *Erythrophloeum africanum* are naturally highly resistant, the heartwood of these species remaining almost unaffected after exposure to intense termite attack for 11 years.

(2) The common *Isoberlinias* and *Brachystegias* were eaten to the extent of 50 per cent. in two years or a little more.

(3) Impregnation at a wide range of absorptions with sodium arsenite or arsenious oxide, preserves the common non-durable woods against termites for six years, that being the

period required for these chemicals to leach out under the conditions of a 50-in. rainfall. Impregnation with zinc chloride (4·75 per cent.) was effective for only two years.

31.43 : 13.2 (68) : 12.26–8. **The Italian beetle.** *Wood* 10, 1945 (34). [263].

Brief notes are given on the feeding habits of, damage caused by, and measures for the control of, the Italian beetle (*Hylotrupes* sp.) and the powder-post beetle (*Lyctus brunneus*), both of which are found in South Africa. The first of these attacks Pine timber and deal, while the second attacks Oak, Walnut, Chestnut, Jarrah and Philippine Mahogany but not Teak, deal or Stinkwood (*Ocotea bullata*).

31.43 : 13.2. DYNES, J. **Taming the teredo.** *B.C. Lumberm.* 29 (2), 1945 (62). [264].

Blasting with dynamite in the vicinity of piling has been found to be effective in destroying teredo life in the timber. Experience of the Comox Logging and Railway Company, Ltd., Vancouver Island, has shown that blasting at two-month intervals increases the life of all piling by 3–4 years.

31.45. Injury by Fire

31.45. MCNAUGHTON, G. C. **Ignition and charring temperatures of wood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1464, 1944. pp. 3 + tbls. P.R. [265].

In order to show the importance of time in the effects of heat upon wood, tests were made using small kiln-dried samples of Hard Maple which were subjected to temperatures ranging from 107° to 150° C. for various extended periods in electrically controlled drying ovens. With prolonged exposure (up to 1,235 days at 120° C.) at all temperatures there was a gradual darkening of the wood, accompanied by loss of weight and shrinkage in the transverse dimensions of the specimen, but none was ignited during exposure. Results are tabulated and data are also given for duration of exposure before ignition at temperatures ranging from 180° to 430° C. for samples of a number of species.

31.8. *Quality and Defects of Timber*

31.8 : 12.26–8 : 33.15. DAVIS, E. M. **Aircraft veneers in Yellow Birch, Hard Maple, Yellow Poplar and Sweetgum. The application of specification AN–NN–P–511 b. to certain defects that are not specifically covered therein.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1599, May 1944. pp. 9 + tbl. + figs. P.R. [266].

The primary object of this report is to describe and illustrate certain defects not covered in the official specification AN–NN–P–511b. in order to determine to what extent they are acceptable in aircraft veneer. The report is limited to the four North American hardwoods used in aircraft construction.

In addition consideration is given to the frequency of occurrence of different defects in these four species in order to indicate the nature of the defects in each species that must be dealt with if a larger proportion of the cut is to be accepted for aircraft veneers. An attempt is also made to clarify distinctions between knots, burls, and localized short grain, which have caused some confusion in the application of specifications.

31.8 : 33.15. **Compression wood: importance and detection in aircraft veneer and plywood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1586, 1943. pp. 6 + figs. P.R. [267].

The characteristics and properties of compression wood are discussed and methods for its detection by reflected and transmitted light are described. Compression wood, particularly in its more pronounced forms, seriously affects the strength and stability of aircraft parts, and its use in veneer and plywood for this purpose is restricted on the basis of the width of the streaks. However, as it is difficult to obtain large quantities of softwood entirely free from compression wood, a limited amount that will not seriously affect strength properties is allowed to be used in aircraft plywood.

31.8 : 12.26–8 : 33.15 : 31.27. HANSBOROUGH, J. R., and KRAUSE, R. L. **The significance of the discoloration in aircraft veneers: Mahogany and Khaya.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1379, 1943. pp. 7 + figs. P.R. [268].

Descriptions and illustrations are given of the common discolorations and decays of the wood of Mahogany (*Swietenia macrophylla*) and of *Khaya ivorensis*, together with the results of tests made to compare the toughness of discoloured wood with that of clear wood from the same sheet of veneer. Occasional and common forms of discoloration are iron

stain, mineral streaks, end stain, worm streak, red streak, side stain and gum streak. The first five of these indicate deficiency in toughness varying from none to moderate; they are not prohibited by the Army-Navy Specification AN-NN-P-511b. and may be disregarded. Side stain and gum streak are not specifically prohibited, but they indicate sufficient deficiency in toughness to make their exclusion desirable.

Decay, which is indicated by white, grey, or greyish-brown discolorations, is prohibited by the specification.

32. HARVESTING OF WOOD. LOGGING

32 (51) : 12.19. WANG KAI. **Survey on logging industry in Kweichon-Kwangsi-Hunan Border.** Typescript. [1944?] pp. 11. [Forest Products Laboratory, National Bureau of Industry Research, China.] [269].

After a general historical account of the logging industry in the area, the writer deals with forest rights and labour conditions, felling and logging tools and methods, and transportation of timber both by land and water. There is no mechanization, and transport is effected by man-handling of logs down chutes to the rivers, when they are floated singly down the smaller rivers, or in rafts on the larger ones. Small trees are felled by axe several inches above the ground; if the diameter exceeds 8 inches, the usual practice is to remove the earth from the roots with the aid of a hoe and then cut the roots into the shape of a pot. This process, though time-consuming, results in more complete utilization.

32–3 : 01.6. **List of publications on logging, manufacture and utilization of timber, lumber and other wood products.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*790, 1944. pp. 27. P.R. [270].

A list of publications showing the results of research by the U.S. Forest Products Laboratory on methods and practices in the lumber-producing and wood-consuming industries; standard lumber grades, sizes and nomenclature; production and use of small dimension stock; specifications for small wooden products; utilization of little-used species and commercial woods; and surveys of low-grade and waste wood. Included also are other Government and commercial publications on these subjects.

32.1. *Marking of Trees and Coupes*

32.1. HOUGH, A. F. **A quick method for temporary tree numbering.** *J. For.* 43, 1945 (142–3). [Allegheny Forest Exp. Sta.] [271].

Small numbered slips of paper can be quickly and easily attached to the bole of a tree of any species by using a commercial Bostick-type 'tacker'. The slip of paper usually lasts at least a month and no splitting of hardwood results from the wire staples, as is the case with tacks or nails.

32.1 : 07.7. BRATTON, A. W., and FERGUSON, R. H. **Use of the spray gun in marking timber.** *J. For.* 43, 1945 (113–7). [Allegheny Forest Exp. Sta., Cooperstown, N.Y.] [272].

Since 1936 more than 12 million bd. ft. of timber have been marked effectively and economically with a paint spray gun in the neighbourhood of Cooperstown, N.Y. The advantages of the spray gun are that trees can be marked more quickly and from a greater distance than with an axe; its use is easier and less tiring than that of an axe; the paint marks are highly visible and will last from 5 to 6 years; the gun can be used in any weather; paint-marked trees are not exposed to damage from insects and disease as is the case when marking causes a wound; straight lines or spots can be made and the colour of the paint changed, thus providing a considerable number of combinations of marks. The disadvantages are that the paint mixture is bulky and weighs more than an axe; the gun must be maintained; the paint must be prepared; the gun may occasionally clog and cannot be used, like an axe, for sounding trees to test for hollowness; greater operating distance from the trees may lead to looser inspection of the trees marked; paint marks are more easily counterfeited than stamped blazes. The article gives a detailed account of the Alemite Spring Spray Gun, Model 6121, and its use.

32.2. *Felling and Related Operations*

32.25 : 07.7. **The 'Precision' power chain saw.** *Sth. Lumberm.* 169 (2129), 1944 (266, 268). [273].

Brief descriptions are given of three models of a petrol-driven chain saw manufactured by

Precision Parts Ltd., of Montreal. Type 1 weighs 38 lb. and is a bow saw developed for felling and cross-cutting pulpwood; it has a 15-in. blade, can be operated by one man, and does not bind in cutting small material. Type 2 weighs 33 lb., has a 15-in. blade, and is equipped with a mortising attachment. Type 3 weighs 38–45 lb., has standard 20-, 26-, and 32-in. blades, and is operated by two men.

32.25 : 07.7. RICH, J. H. **Use and adaptation of power saws for pulpwood harvesting.** *Sth. Lumberm.* 169 (2129), 1944 (175–9) [274].

Possible developments in power saws and their use for felling and cross-cutting are being investigated by the U.S. Forest Products Laboratory as part of a programme for improving methods in pulpwood harvesting. In this article the author discusses the characteristics, adaptation, operation and maintenance of (*a*) portable circular power saws of the push-cart type, (*b*) portable chain power saws, (*c*) drag saws, (*d*) circular swing saws, and (*e*) portable and stationary slasher saws.

32.25.5 : 07.7. MURRAY, A. **The Waterous friction log barker.** *Pulp Paper Mag. Can.* 46, 1945 (176–8). [275].

A brief illustrated account is given of a unit that has recently been developed and has proved successful in operation. A continuous movement of logs is maintained, the rate at which they are barked varying from 150 to 400 per hour. When full, the hopper of the unit holds 60 logs up to 17 ft. long and averaging 6.3 cu. ft.

32.25.5 : 07.7. SHAW, E. C. **New hydraulic barker for logs, slabs and edgings.** *Sth. Lumberm.* 169 (2129), 1944 (264–5). [276].

Description of a new hydraulic barker for large round logs, and a redesigned hydraulic barker for slabs and edgings, both manufactured by the Allis-Chalmers Manufacturing Co.

32.29.2 (73). [ROGERS, N. C.] **New ideas in slash disposal.** *Timberman* 46 (4), 1944–45 (44). [277].

Some basic principles for slash disposal are set down with reference to various conditions in the northwestern States.

In general, slash should not be burned (1) where 30 per cent. or less of a stand is being removed (except around the landings); (2) when the residual stand is composed chiefly of Spruce, true Firs, Hemlock, and other thin-barked species; (3) where fire hazard is naturally low; and (4) where excessive seed loss and erosion might ensue, or where burning might result in even greater fire hazard than before.

Burning is recommended in areas where the rate of fire spread is high, where there are large areas of slash, and where the layer of slash and litter is so dense that there is little chance for the establishment of reproduction.

32.8. *Grading and Storage of Wood in the Rough*

32.81 : 12.25–8(76.5) : 52.43.2. KELLOGG, L. F., and KUENZEL, J. G. **Lumber grade recovery from Shortleaf Pine and mixed Oak in northern Arkansas.** *J. For.* 43, 1945 (10–15). [278].

The present forests of the Ozarks region in northern Arkansas consist largely of hardwoods, mostly Oaks, of medium to poor quality; there are also considerable areas containing Shortleaf Pine (*Pinus echinata* Mill.) either in Pine/Oak type or in pure stands. In the process of improving these stands, foresters are faced with the problem of removing large volumes of the less desirable species. Little specific information that can be used in appraising and selling timber is available on log grades, proportion of logs by grade, and yield in timber by grades from trees and logs of various sizes. In order to obtain such information, a study was made on logs cut during November and December, 1940, on a typical rough area of the Ozark National Forest. The forest consisted of Pine, Oak and Pine/Oak stands, even-aged over small areas, and varying from 40 to 200 years old. Shortleaf Pine gave 33·8 per cent. of grade 1, 42·7 per cent. of grade 2, and 23·5 per cent. of grade 3 logs. In contrast, the Oaks gave 4·8 per cent. of grade 1, 20·5 per cent. of grade 2, and 74·7 per cent. of grade 3 logs. Tables of timber grade recovery are given by tree diameter, log grade and log size. These data emphasize the low recovery of upper grades in small logs and trees, and provide a partial basis for stumpage appraisals and determination of marginal tree sizes.

32.82 (485) : 31.42–3 : 76.1. NENZELL, G. Något om metoder och kostnader vid sommarlagring av timmer i skogen. **[Notes on methods and costs of summer storing of**

timber in forests.] *Skogsägaren* 19, 1943 (98–105). [279].

Timber should be stored unbarked except when insect attack is unavoidable; it should then be completely barked before storage. According to the nature of the locality, timber may be stored in water, on bog soil, or on mineral soil.

Unbarked Pine timber should be sprayed, laid in piles and covered before the shoot borers swarm (late April and early May). Operations with Spruce timber can be continued somewhat longer, as the Spruce bark borer normally swarms 3 to 4 weeks later than the shoot borer.

Directions are given for the preparation and application of insecticides. Z 320, a zinc arsenate preparation manufactured by Bolidens Gruvaktiebolag, Stockholm, mixed in water with finely crushed soda and freshly slaked lime, will give unbarked logs complete protection from insect attack during the summer, provided the stored logs are well protected from rain by a thick layer of peat or grass turf. Methods of constructing and covering the piles are described.

Barked timber is sprayed with a fungicide, e.g. ethyl mercury chloride. Fibrosan is the preparation now sold in Sweden for protection against blue stain; it is obtained in powder form, 150 gm. being dissolved in 15 l. of water.

Figures are given to show the cost of the different operations in the summer storage of completely barked Pine and Spruce timber in Ljusdal in 1942. R. P. J.

32.9. *Transport*

32.91 : 07.7. Burk, A. H. **Mechanical loaders.** Canadian Pulp and Paper Association, 3420, University Street, Montreal. 1944. pp. 8. [280].

The various types of mechanisms and systems that have been used or experimented with for loading pulpwood in Canada are listed and briefly described, the available literature on each type is noted and abstracts are given.

32.92 (481) : 52.43.2. Innstilling avgitt av Landsbruksdepartementets Tömmersvinnkomite. [**Report by the Committee of the Royal Norwegian Ministry of Agriculture on timber losses.**] *Skogeieren* 31 (7), 1944 (50–74). [Nor.] N.D.A. [281].

In Norway about 70 per cent. of the total annual cut (varying from 2 to 5·6 million cu. m.) is floated down the rivers from the forests to the sawmills and pulp factories near the coast. Recently a comprehensive study has been made on the floating of timber and the losses resulting therefrom, which amount to 3–4 per cent. of the total volume and represent an annual financial loss of about 1 million kroner. In the present report the important factors affecting log loss through sinking and other causes are discussed and recommendations are made on methods for reducing these losses.

The following table shows in detail the items contributing to the difference between the

	Loss in volume due to errors in measurement in forest or to shrinkage. per cent.	*Total per cent.*
A. *Apparent losses.*		
1. Overscale due to a single horizontal diameter measurement	4	
2. Overscale due to strips of bark left on the logs	2 to 2·5	
3. Overscale due to ice and snow on the logs	0·5	
4. Shrinkage in the millyard	1·0	7·5–8
	Increase in volume due to error in measurement	
5. Underscaling where diameter is read down to nearest whole or half cm.	3	
6. Error in the formula (mid-area by height)	1·5	4·5
Total apparent losses		3–3·5
B. *Real losses.*		
7. Through sinking	2–3	
8. Through breakage, wear and tear, and theft	1	3–4
Difference between volume of timber entering the river and that entering the mills.		6–7·5

volume of timber measured and paid for on the river bank and the volume entering the mills, on the largest river in Norway.

32.92–4(71.1). **Towing logs in British Columbia.** *Timberman* 46 (4), 1944–45 (122, 124, 126). [282].

This is an abstract of a pamphlet relating to the towing and handling of logs in British Columbia waters, by B. L. Johnson, Walton Co. Ltd., Vancouver, entitled 'Flat Boom Insurance and Loss Problems'. It reproduces a number of diagrams from the pamphlet, showing construction, fastening and repairing of booms, and tables showing the relative buoyancy of boomsticks of Western Red Cedar, Douglas Fir and Western Hemlock.

32.95 : 07.7. **Skyhook: newest idea in cable logging.** *Timberman* 46 (5), 1944–45 (34–5, 76). [283].

Description of a new type of skyline equipment which consists of a double skyline of 2-in. rope hung from head and tail trees, the parallel ropes being 30 inches apart, with two smaller ¾-in. ropes parallel to each of the big ropes, to engage the sheaves on the carriage. Engine driving mechanism, yarding drum and operator are all carried on the line, and the yarding unit can go right over a log or to a spot where it can lead a log to the skidding track. In demonstrations at Molallee, Oregon, the 'Skyhook' has been able to handle loads of 5,000 ft. With a crew of 5 men (one operator and 4 on the ground) it showed itself capable of yarding out about 150,000 ft. a day on a 2,000 ft. span with grades running up to 30 per cent. Work is in progress on an improved model.

32.96 : 33.02 : 07.7. **'Skid-Loader' speeds pulpwood loading.** *Sth. Lumberm.* 170 (2135), 1945 (62). [284].

The Drott Skid-Loader, manufactured by the Hi-Way Service Corporation, Milwaukee, Wisconsin, moves a cord of pulpwood from pile to truck in 1½ minutes. The unit consists of a steel frame with a rack attachment and is mounted on a 60 h.p. Diesel tractor. It is hydraulically operated and has a lifting capacity of 6,000 lb. and a loading height of 10 ft.

33. CONVERSION AND PRESERVATION OF WOOD

33 : 07.2 (73). WINSLOW, C. P. **Wood research pays high dividends.** *Timberman* 46 (4), 1944–45 (62, 64, 66, 68, 70–1, 74, 76). [285].

This article reviews some of the fields in which research at the U.S. Forest Products Laboratory has led to great saving of money and material. These include the development of the internal fan system of controlled drying, chemical seasoning with urea, timber connectors and laminated arches, grading of structural timber, glues and plywood, pulp and paper. It is claimed that taken collectively they constitute a contribution to the national welfare which makes the cost of maintaining the laboratory microscopic by comparison. Other objects of research at the Laboratory during the war, and still in progress, are new materials such as papreg, wood plastics, compreg and staypak; glued laminated keels and ribs; production of sugar and alcohol from wood; wood for aircraft; fireproofing; packaging and loading of commodities for overseas shipment.

33.1. *Mechanical Conversion excluding the Manufacture of Mechanical Pulp*

33.15. Manufacture of Veneers, Laminated, and 'Improved' Wood. Gluing

33.15. PERKINS, N. S. **Plywood developments.** *Sth. Lumberm.* 169 (2129), 1944 (280–2, 284). [286].

A recent development in plywood is the use of plastic overlays or plastic-faced plywood; the new plastic surface increases the rigidity and stability of the plywood and gives a glass-smooth surface with high abrasion- and moisture-resistance. Fibre-glass impregnated with phenolic or melamine resin is also used as an overlay material and is bonded to plywood in hot presses, and experiments have been made with metal-faced plywoods. Other points dealt with in this article are water-repellent and other treatments, large-sized plywood panels, plywood beams and girders, and the testing of plywood panels. The American plywood industry has now established a substantial fund to finance a Plywood Research Foundation; the foundation is to be supported entirely by the plywood industry, and the studies will be directed solely for development of forest products of commercial

importance in addition to those now being manufactured.

33.15. ZEELANDER, J. (Compiler). **'Mechanical World' flowsheet No. 134—plywood manufacture.** *Mech. World* 117, 1945 (211–2). P.R. [287].

Descriptive notes are given on each consecutive operation in the manufacture of plywood from the time the logs are received in the factory until the finished sheets are produced.

33.15. HARRISON-SMITH, J. L. **Plywood.** *N. Z. J. For.* 5, 1942–44 (35–41). [288].

A general article describing the consecutive operations in the manufacture of plywood, including the preparation of logs, peeling, drying veneer, gluing, pressing, and the drying and trimming of plywood.

33.15. HEEBINK, B. G. **Bag-molding of plywood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1431, 1943. pp. 7 + fig. P.R. [289].

In general the technique for bag-moulding or fluid-pressure moulding of plywood consists in attaching temporarily superimposed layers of glue-coated veneers to a mould of the desired shape, and moulding these into a unit structure by the application of heat and fluid pressure through a flexible, impermeable bag or blanket. A brief account is given of the process, equipment, moulds, bags or blankets and glues used.

33.15. BRUMLEVE, C. C. **What HF heating means to the plywood industry.** *Sth. Lumberm.* 169 (2129), 1944 (285–8). [290].

The use of high-frequency equipment in the manufacture of plywood is described and the advantages of this method in comparison with the cold-setting process are enumerated.

33.15. JARRARD, W. J. **Production of laminated wood.** *British Patent* No. 562,892, Jan. 13, 1943. Brit. chem. physiol. Abstr. B1, 1944 (369). P.R. [291].

In the making of laminated wood (containing thermosetting or thermoplastic resin) by pressure and diathermy, even distribution of the equipotentials and uniform heating are achieved by arranging air spaces or bodies of other dielectrics in the neighbourhood of the sheets being treated.

33.15 : 38.1. JERVIS, A. E. L. **Present and future application of laminated densified wood.** *Brit. Plastics* 16, 1944 (478–84). L.S. [292].

After pointing out some of the reasons for a probable future expansion in the use of laminated wood, the author discusses developments in the application of this material in the electrical, tool-handle, pottery, aircraft and building construction industries.

33.15 : 31.27. KUENZI, E. W. **Effect of length on the buckling stresses of thin-walled plywood cylinders in axial compression.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1514, 1944. pp. 8 + tbls. + figs. P.R. [293].

Tests were made on short, thin-walled plywood cylinders loaded in axial compression. All specimens were of Yellow Birch or Yellow Poplar plywood made from aircraft-grade veneers. Results show that, in general, primary failure of all cylinders was by localized buckling, the critical buckling load often being evidenced by a sudden failure in which many indentations or buckles appeared at the same moment at different points on the cylinder.

An empirical design curve presented for plywood cylinders of lengths shorter than the diameters is in reasonable agreement with published results of similar tests on metal cylinders.

33.15 : 31.27. DIETZ, A. G. H., and GRINSFELDER, H. **Fatigue tests on compressed and impregnated laminated wood.** *Bull. Amer. Soc. Test. Mat.* No. 129, 1944 (31–4). [Massachusetts Institute of Technology, Cambridge, Mass.] P.O. [294].

Details are given as to materials, specimens, methods and results obtained in a series of tests made to determine the endurance characteristics and fatigue limits of a number of representative types of compressed and impregnated wood, the material in some instances being cross-bonded and in others laminated. The specimens were subjected to static tests for modulus of rupture and modulus of elasticity, and also placed in a standard rotating beam machine in which a constant bending moment is applied to the specimen.

33.15 : 31.27. ULRICH, M., and MÜLLER, F. **Strength of gear wheels made from laminated plastics.** *Kunststoffe* 32 (9), 1942 (270–3). [G.] [Ministry of Aircraft Production, *R.T.P. Transl.* No. 1876. pp. 5 + figs. + tbls.] I.F.B. [295].

An account is given of strength tests on gear wheels made from various laminated plastics including pressed wood; results are tabulated. The plastic-wood gear wheels were made from round pressed blanks, the grain of the veneers being radially staggered to obtain uniform strength at the circumference of each wheel.

33.15. MAXWELL, J. W. **Shear strength of glue joints as affected by wood surfaces and pressures.** *Tech. Publ. N.Y. St. Coll. For.* No. 64, 1944. pp. 25. [296].

The study reported in this bulletin was undertaken to obtain basic information on the bonding of wood, and to show the types of surfaces and gluing pressures that will produce the strongest glue joints. Materials used were urea-formaldehyde cold-setting glue and kiln-dried Sugar Maple (*Acer saccharum*) wood.

The thicker and more irregular the glue line the weaker the bond: hence relatively smooth (planed) surfaces result in the strongest glue joints, splintered and irregular surfaces giving much poorer adhesion. Burnished surfaces, although smooth, do not produce good joints because of charring and polishing.

So far as Hard Maple is concerned, it appears that the pressures commonly used in practice have little effect on the penetration of cold-setting urea-formaldehyde glue except into those cells, the cavities of which are open to the spread surface.

It is pointed out that 'specific adhesion' and 'mechanical adhesion' are largely responsible for the adhesive strength between glue and wood.

33.15. BRUCE, H. D., OLSON, W. Z., BLACK, J. H., and RAUCH, A. H. **Gluing with low-temperature-setting phenol, resorcinol and melamine glues. Development of joint strength in Birch plywood cured at several temperatures for various periods of time.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1531, 1944. pp. 4 + tbls. + figs. P.R. [297].

In order to obtain information on the curing characteristics of certain commercial low-temperature glues, Birch plywood was made with them by pressing at several temperatures for various lengths of time, and the strength of the joints so made was ascertained by sheer tests. Curves are given on which to base estimates of the length of time required to heat these particular low-temperature-setting glues on Birch. Preliminary work indicates that all these curves are also applicable to Mahogany and Spruce, and that those for the melamine glues are applicable to Sweetgum, White Oak, and Douglas Fir.

33.15. ROMIEUX, C.J. **Melamine resins: their properties and applications.** *Pulp Paper Mag. Can.* 45, 1944 (532–4). [298].

It has been found that the addition of relatively small proportions of melamine resins to urea resins produces glues of bonding quality very much superior to that of the urea glues themselves. Tests were made to show the effect of increasing additions of melamine upon the wood failure in test samples broken in sheer, when tested after 24 hours soaking in water at 75° F. In all cases the loadings at which failure took place were well above the values specified for plywood bonded with urea resins. Whereas urea resin bonded plywood delaminates completely after boiling in water for 3 hours, the addition of 5 per cent. melamine provides a bond which remains intact after boiling and breaks at a sheer strength of 125 lb./sq. in.; the addition of 10 per cent. melamine provides a bond with a sheer strength of 260 lb./sq. in., and the addition of 15 per cent. provides one with a strength 290 lb./sq. in.

33.15. RHODES, P. H. **Resorcin resins and adhesives.** *W. Cst. Lumberm.* 72 (1), 1945 (96c, 96e). [299].

Resorcinol-formaldehyde glues such as Penacolite G-1124 and Penacolite G-1131, which have been developed by the Pennsylvania Coal Products Co., provide bonds that are completely waterproof and non-corrosive. To effect complete cure it is necessary to add only formaldehyde solution or paraformaldehyde powder. The glue solution and film are neutral, or very slightly alkaline. Although these adhesives were originally developed for room-temperature bonding, it has been found that increased temperature greatly accelerates cure, e.g. at a glue line temperature of 180° F. cure is effected in 5 or 6 minutes. The use of higher than room temperatures is particularly prevalent in the manufacture of heavy laminated timbers for boat building, and it has been shown that temperatures as low as 140° F. are sufficient with these resins for the production of laminated White Oak timbers for ship use. Wide application has also been found in the production of plywood tubing.

33.15. PRESTON, R. J., and KAUFERT, F. H. **Bleed-through of glue in aircraft plywood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1541, 1944. pp. 9 + tbls. + figs. P.R. [300].

'Bleed-through' is the term commonly used to designate glue deposits on the surfaces of plywood panels that result from the penetration of glue from the joints during hot pressing.

The following are summaries of the results of investigations reported in this bulletin on problems relating to bleed-through on aircraft plywood:—

(1) The amount of bleed-through produced on laboratory-made panels of thin aircraft plywood was appreciably affected by the following: moisture content of veneers at the time of hot-pressing; slope of grain in the face of veneers; thickness and species of face veneers; amount of glue spread; species and type of wood (sapwood or heartwood) used for cores.

(2) The degree of interference with adhesion of cold-setting glues used for secondary gluing was not serious with light to moderate bleed-through, but increased in the presence of heavy or very heavy bleed-through. Light sanding before secondary gluing proved to be the most effective method of treating surfaces showing heavy bleed-through.

(3) There was no evident correlation between bleed-through and the quality of primary glue joints in plywood made within the range of conditions normally encountered in the manufacture of aircraft plywood.

33.15. HODGINS, T. S. **Resin-bonded plywood.** *Timberman* 46 (3), 1944–45 (122, 124, 126, 128). [301].

A brief account of the types of glues used, their application, and the methods and conditions for assembling, pressing and moulding the veneers in the manufacture of resin-bonded plywood.

33.15 (73) : 33.03. DAVIS, P. M. **Waste in veneer manufacture.** *Timberman* 46 (5), 1944–45 (64, 66). [U.S. Forest Products Laboratory, Madison, Wis.] [302].

Recent investigations at the U.S. Forest Products Laboratory based on studies of Yellow Birch veneer production at commercial mills in the United States have demonstrated that the average log yields only about 47 per cent. of its cubic volume (after removal of bark) in merchantable veneer. To this must be added the 50 per cent. loss reported by plywood manufacturers in converting hardwood veneer into plywood. This article summarizes the various kinds of waste which occur.

33.15 : 33.36.1. **Resin-impregnated plywood surfacing.** *Mod. Plastics* 22 (3), 1944 (118, 212). P.R. [303].

In order to improve the characteristics of plywood for use under extremes of climate, a new type of phenolic resin impregnated paper has been developed for application to the base plywood to form a tough waterproof skin. The surfacing material is impregnated with resin in the paper-making process, thus reducing the cost compared with the earlier method of producing a thin laminate and then gluing it to the core. The properties of phenolic resin impregnated surfacing are tabulated.

New methods of plastic surfacing Douglas Fir plywood are being investigated.

33.15. **Staypak—improved wood without resins.** *J. For.* 43, 1945 (143–4). [304].

Staypak is a heat-stabilized high-density product, developed by the U.S. Forest Products Laboratory, and made by compressing either solid wood or many layers of thin veneers; it contains no resin other than that used in the veneers for the laminated product.

Compared with resin-treated compressed wood (compreg), Staypak is about twice as tough, its compressive strength is somewhat lower and its bending properties are about 25 per cent. higher. Tensile and flexual values of the laminated material range from about 40,000 to 45,000 lb./sq. in. Staypak is somewhat darker than ordinary wood; it machines well with metal-working tools and takes a good polish on all cut surfaces.

The cost of Staypak is roughly proportional to the increase in specific gravity as compared with uncompressed wood. For details of manufacturer see *Mimeo. U.S. For. Prod. Lab.* No. 1580.

33.15. **Urea-plasticized wood (Uralloy).** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1277, (revised) 1943. pp. 6. P.R. [305].

Two lines of investigation that have been followed in developing the wood-plasticizing properties of urea at the U.S. Forest Products Laboratory are described in this paper:— (1) Simple impregnation of wood with urea, followed by drying and bending with the aid of heat (Uralloy A). (2) A thermosetting

process involving the treatment of wood with a urea-formaldehyde solution to be immediately followed (without drying) by bending and heating (Uralloy C). Reference is made to both the methods of treatment used and the properties of the resulting products.

33.17. Sawmilling

33.17. BUNNETT, L. E. **Conversion waste.** *Wood* 10, 1945 (85–6). [306].

Milling waste is directly related to three variables—width of saw-cut, depth of surfacing (planing) cut, and cross-section of the finished product—and can be accurately assessed by taking these into account. The first two variables depend on the design of saws, the care with which they are set, and the setting and sharpening of planes. Assuming a saw kerf of $\frac{1}{8}$ in. and a planing depth of $\frac{1}{16}$ in., the author has prepared a chart for use in calculating the allowance to be made for waste in converting timber of various sizes.

33.17 : 07.7. BIRCH, J. F. **Band saws and their maintenance.** Gibbs, Bamford and Co. (Luton) Ltd. 1945. pp. 71. [307].

This booklet, which deals with both wide and narrow band saws, gives instructions for the ordering, fitting, repair and maintenance of saws.

33.17 : 07.7. MITCHELL, T. **Portable sawmills become precision machines.** *Timberman* 46 (5), 1944–45 (46–7, 49). [308].

Portable sawmills are built in a number of sizes, with circular saws 42–66 in. in diameter. Power units of 35–125 h.p. are used in operating a modern mill. The smallest mills will saw from 4 to 10 thousand bd. ft. of lumber per day, while the largest will produce up to 30 thousand ft. Among the many improvements made in these mills in recent years are various self-adjusting devices to ensure greater accuracy, an easily operated belt feed, and circular saws with inserted teeth which reduce filing and maintenance requirements.

33.17 : 07.7 : 33.15. **Plywood saw.** *Mech. World* 116, 1944 (727). [Thomas White and Sons Ltd., Paisley.] P.R. [309].

Reference is made to a motor-driven saw 15 in. in diameter specially made for sawing plywood, plasterboard and all kinds of composition board in large sheets.

33.19. Other Forms of Mechanical Conversion

33.19 : 34.6. ARIES, R. S. **Wood flour from sawdust and shavings.** *Timber of Canada* 5 (6), 1945 (39–43, 46–8, 76, 82–8). [310].

A general account of wood flour and the wood flour industry in North America, with reference to sources of supply, particularly as wood waste; properties, grades, types and uses of wood flour; species of wood and methods used in its manufacture; cost of production.

Present consumption of wood flour in North America is about 75,000 tons annually, of which about 75 per cent. is used in the United States. While the uses for wood flour may be expected to increase in the future, there is an abundance of raw material available for this purpose in North America, the potential supply being in fact much greater than the potential demand.

33.3. *Chemical Treatment*

33.32. Pulp and Paper Manufacture. Plastics.

33.32 (485). JAHN, E.C. **Wartime developments and postwar plans of the Swedish pulp and paper industry.** *Pulp Paper Mag. Can.* 46, 1945 (318–22). [New York State College of Forestry, Syracuse.] [311].

The principal trends of the pulp and paper industry in Sweden during the war have been a greater emphasis on high quality bleached sulphite and sulphate pulps, production of viscose pulp, the manufacture of kraft spin papers, and by-product development based on organic chemicals from alcohol, tall oil products, cellulose derivatives and lignin. During the severe winters of 1940 and 1941 the pulp industry was called upon to produce a special digestible type of pulp for animal fodder; this was made by both the sulphite and sulphate processes, using conditions to produce an overcooked soft pulp.

The development of a stable fibre (cell wool) industry in Europe, particularly in Italy and Germany, led to an increased production of viscose pulp, of which 300,000 metric tons were exported in 1942, the peak year. There is great interest in high alpha pulps and research is being carried out on special pulps for esters and ethers. A great deal of tough M.G. kraft, having a breaking length of about 12,000 m., is being made. This is cut into 8-mm. widths

and spun into binder twine for harvesting, or is woven into sacks and cloth for furniture and carpet foundation.

An account is given of standard pulping practices in Sweden for sulphate and sulphite processes. The principal new development during the war has been in the field of bleached pulps, especially bleached sulphite for the viscose market. For ordinary sulphite viscose pulp (89 per cent. alpha) the bleaching consists of treatments with chlorine, alkali and calcium hypochlorite in 3 to 5 stages. Treatment in the alkaline tower is at high consistency and may be at low (20° C.) or elevated temperatures (60–100°). Chlorine and alkali consumption averages 15–20 kg. and 10–15 kg. respectively, per ton of pulp. For special high alpha pulps, the material is given additional alkaline treatments after the bleaching operation and may be given a final bleach with chlorine dioxide.

New developments have been made in the evaporation of both sulphite and sulphate waste liquors. Several systems are in operation, and the mills using them make high claims as to their efficiency, costs, heat return and chemical recovery. Other technical developments of interest are continuous semi-chemical pulping in combination with Asplund defibrators; continuous kraft cooking; use of soda sulphite liquor by one mill; pilot plant experiments in cracking alkaline waste liquors to produce liquid organic compounds; and a simplified method of water filtration.

The pulp companies are greatly interested in cellulose derivatives. There is a small production of cellulose glycollate ether and of ethyl ethers. The glycollate ether is water soluble and used for adhesives, particularly for wallpaper, textile sizing, and to give body to various types of food. About 15,000–17,000 metric tons of tall oil are being processed into high-grade rosin, soaps, insulating cable oils, sulfurated oils, fuel oil, etc. About 80 per cent. of Sweden's soap is now made from tall oil.

One of the most impressive war-time by-product developments is the building-up of an organic chemical industry based on sulphite alcohol. Thirty-three sulphite mills now have alcohol plants and the total annual capacity is about 120 million l. of 95 per cent. alcohol. Some of this goes to distilleries, some is used for motor fuel, but a large amount is the base for organic industrials such as glycol, butanol, crotonaldehyde, ethyl and butyl-acetates, etc.

33.32 : 07.1–2 (71). MAASS, O. **The Pulp and Paper Research Institute of Canada.** *Pulp Paper Mag. Can.* 46, 1945 (145–8). [312].

An article dealing with the history and aims of the Pulp and Paper Research Institute of Canada. In addition to carrying out actual research the Institute has an excellent reference library and training courses have been arranged. A highly qualified staff is gradually being built up.

33.32 (94) : 12.26–8 : 98.1–2. SANDWELL, P. R. **The Australian pulp and paper industry.** *Pulp Paper Mag. Can.* 46, 1945 (309–13). [313].

The Australian pulp industry based on the use of indigenous raw materials did not start until just before the second world war; there are now five mills manufacturing paper and building material from Australian wood.

The only native species available in any great volume are the Eucalypts—hardwoods with short fibres and high acid content—both factors that are unfavourable to pulp production. Of these species only *E. regnans* can be used in the groundwood process, and this requires special precaution against staining; none of the Eucalypts are suited to the acid pulp process. However, there are at least 10 species that can be used in the alkaline process and many species can be used in the production of Masonite; the resulting Masonite hardboards appear to be superior to the softwood products made in North America. The reaction of Eucalypts to the various semi-chemical processes which are now being developed for North American hardwoods is not yet known.

Australian consumption of pulp and paper products is greatly in excess of the present capacity of the local industry, which manufactures approximately 30,000 tons of newsprint, 20,000 tons of printing and writing papers, 140,000 tons of wrapping paper and board, and 10,000 tons of Masonite.

33.32. LOUGHEED, E. H. **Pretreatment of wood before grinding.** *Pulp Paper Mag. Can.* 46, 1945 (165–75). [314].

A detailed illustrated account is given of investigations undertaken to determine whether the pretreatment of wood, such as Spruce or Jack Pine, with sodium sulphite or sodium carbonate solutions is a practical proposition.

The process was shown to be potentially profitable, and in any high cost mill or where sulphite pulp cost is high, the saving by the use of treated wood should be appreciable.

33.32. MOORE, T. R. **Wood cleaning *vs.* pulp cleanliness.** *Pulp Paper Mag. Can.* 46, 1945 (198). [315].

Small-scale tests made in an experimental digester showed that the dirt count on pulp from uncleaned chips was four times greater than that from cleaned chips. The amount of wood, bark dirt, etc., removed from the clean chips for this test is compared with that removed ordinarily at the mills in eastern Canada.

33.32 : 31.2–3. MOORE, T. R., and YORSTON, F. H. **Wood properties in relation to sulphite pulping.** *Pulp Paper Mag. Can.* 46, 1945 (161–4). [Technical Section, Canadian Pulp and Paper Association.] [316].

A review of published information on the sulphite pulping process with particular reference to (1) the effect of the chemical composition, physical properties, chipping and defects of wood on pulp quality, and (2) the penetration of acid into wood. The review is based on 30 literature references.

33.32 : 12.26–8. NIHLEN, H., and MCGOVERN, J. N. **Suitability of Birch, Aspen and Sugarberry for rayon pulp: results of certain sulfite pulping and bleaching experiments.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1441, 1943. pp. 11 + tbls. P.R. [317].

Sulfite pulping and bleaching experiments were conducted on three hardwoods, Birch (*Betula papyrifera*), Aspen (*Populus tremuloides*) and Sugarberry (*Celtis laevigata*), to determine the suitability of their pulps primarily for purification to rayon-type pulps and incidentally for paper-making purposes. The following results were obtained: (1) Birch sulfite pulps had progressively decreasing bleach requirement and increasing purity with increasing cooking time, other cooking conditions being the same. The pulps had the average strength of hardwood sulfite and, except for a high ether solubility, were fairly well purified. Three-stage bleaching treatments were applied to the easiest-bleaching pulps which included studies of the variables of consistency, extraction temperature, calcium versus sodium hypochlorite in the third stage, and several variations of procedure to reduce the pulp resin content. Pulps of fair rayon quality, but with high ash and resin contents, were produced. An oxidizing pretreatment slightly reduced the ether solubility. (2) Aspen pulps suitable for paper making and purification purposes were produced in high yields. Those suitable for paper making were less delignified and had higher strength properties than the others. The more delignified pulps were given three-stage bleaching treatments, with a comparison of calcium and sodium hypoclorite made in the third stage. Except for their high resin contents, the bleached pulps had promising characteristics for rayon manufacture. (3) Sugarberry yielded a pulp with a low resin content accompanied by low screenings but shivey and hard to bleach. Nevertheless, the pulp was bleached satisfactorily for paper-making purposes, and showed possibilities as a rayon-type pulp. *Authors' summary.*

33.32 : 12.26–8. SEARS, L. G. **The use of Birch as a wood source for groundwood.** *Pulp Paper Mag. Can.* 46, 1945 (185–6). [318].

Mill tests were made to determine the effect of using White Birch (*Betula papyrifera*) wood for mechanical pulp in mixture with the commonly used coniferous woods at the rates of 5, 10 and 20 per cent. Birch. While the results were not entirely conclusive, it appears that the use of Birch as a partial substitute for the coniferous woods is practicable for certain grades and weights of paper, the extent of its use being governed entirely by local factors peculiar to the individual mill.

Even under ideal conditions the quality of the Birch groundwood is somewhat inferior to that made from coniferous wood, and the defects of the Birch are sharply accentuated as wood moisture decreases.

33.32 : 34.6 : 12.25. KINCAID, D. H. **Groundwood from Spruce and Balsam tree tops.** *Pulp Paper Mag. Can.* 46, 1945 (155–6). [319].

Tests of groundwood pulp made from the topwood of Spruce and Balsam Fir show that, while the quality was entirely satisfactory, a definitely slower and shorter stock was produced than that from stem wood. Dirt counts and brightness tests prove that the use of topwood will not introduce dirt into the pulp being made. The article includes tables giving test results, and a bibliography is appended.

33.32 : 07.7. JONES, J. B., and CAIRNIE, J. M. **The Roberts grinder: its make-up and its**

use at Thorold Division Ontario Paper Company. *Pulp Paper Mag. Can.* 46, 1945 (199–204). [320].

A detailed illustrated account, based on experience of the Ontario Paper Company, of the construction and operation of the Roberts grinder for pulpwood. It is a large producer and sufficiently flexible to be used in the manufacture of any type of groundwood pulp. The advantages of continuous grinding, combined with those of hydraulic feed, make for steady operation with a resulting high grade of product.

33.32 : 31.3. COSTER, N. W., and VINCENT, R. **Some aspects of alpha-cellulose from wood pulp.** *Paper Tr. J.* 119 (12), 1944 (27–9). P.R. [321].

The determination and importance of the alpha-cellulose content of wood pulp are discussed. It is suggested that the existing tests are not wholly satisfactory in that they do not indicate all the properties which are necessary in the evaluation of pulp for specified uses.

Alpha-cellulose has been defined as that fraction of the pulp which is insoluble in 17·5 per cent. NaOH at 20° C. having a D.P. of 200 or more. The effects on the yield of a product meeting such requirements by the pulping and bleaching processes and by operating densities and temperature, are given. *From authors' summary.*

33.32 : 12.25 : 31.42.11. TOLSTOBROV, N. E. **Utilization of Pine wood decomposed by white rot for paper manufacture.** *Bumazhnaya Prom.* 18 (8), 1940 (56–8). *Chem. Zbl.* I, 1941 (2887). Chem. Abstr. 83, 1944 (5081). O.R.S. [322].

Pine wood which has been attacked by white rot is suitable only for the manufacture of packing papers of low quality. The pulp prepared from such wood shows decided differences in physical properties from that prepared in the usual chemical process.

33.32. SPEICHER, T. K. **Recent advances in cellulose plastics.** *Pulp Paper Mag. Can.* 46, 1945 (79–82). [323].

This conference paper first gives a general account of the history and special properties of plastics. Before the war they were used mainly for decorative articles, and selection was chiefly made with an eye to appearance and production cost. With the increasing use of plastics for war purposes, interest turned to their physical properties, and improvements have been made in cellulose plastics with respect to a wider useful temperature range, better dimensional stability, less cold flow, and better strength properties. It has been found practicable to use cellulose acetate of higher acetic acid content and greatly reduce the water pickup, with a corresponding improvement in dimensional stability.

Cellulose plastics in general have very high impact-strength and will sustain a considerable sudden shock without breaking. Under a sustained heavy load, however, they all tend to give some cold flow, particularly at high temperatures. Methods have been sought to reinforce these plastics to reduce cold flow and improve impact strength and this has been accomplished to a considerable extent by laminating with a fabric.

Ethyl cellulose plastics may be used at the highest temperatures normally encountered, and they do not become brittle or lose their impact strength at very low temperatures. In this respect and in dimensional stability ethyl cellulose is definitely better than either acetate or acetate butyrate.

A recent advance in technique is the casting of cellulose plastics without pressure. It is possible to make plastics based on ethyl cellulose which, when hot, are fluid enough to pour into a mould.

33.32 : 34.6. **Plastics from sawdust.** *Sci. News Lett., Wash.* 45 (1), 1944 (2). Build. Sci. Abstr. 17, 1944 (809). P.R. [324].

Brief reference is made to the development of a new black opaque plastic of high tensile strength (9,000 lb./sq. in.) and high resistance to moisture absorption and to acids. The material is made from waste sawdust and shavings from sawmills and requires only 25 per cent. resin for its manufacture.

33.36. Preservation of Wood. Seasoning and Drying

33.36.1. *Preservation against Attack by Plants and Animals*

33.36.1 : 01.6. **List of publications on wood preservation.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*704, 1943. pp. 28. P.R. [325].

A list of publications giving general information and results of research by the U.S. Forest Products Laboratory on preservative materials, methods of application, durability and service

records of treated and untreated wood in various forms.

33.36.1 : 33.31 : 31.42.11. [HICKMAN, B.] **Preservation of timbers.** *Wood* 10, 1945 (101–2). [326].

This article deals with the preservation of timber in Great Britain, with reference to types of preservative used, including creosote and its derivatives, and spirit-soluble and water-soluble preservatives; methods of application; and relative advantages and disadvantages of each type.

33.36.1 : 31.42.1. WRIGHT, E., and HARTLEY, C. **Green lumber shipments need protection.** *Timberman* 46 (5), 1944–45 (100, 102, 104). [U.S. Division of Forestry Pathology.] [327].

Recent tests in Oregon and Washington have shown that dipping with common sapstain control chemicals is very effective in preventing both stain and decay, even in lumber that is tightly bulk-piled immediately after sawing. The tests were made with rough green 1 × 6 in. lumber in pieces 2 ft. long, dipped in full strength sodium chlorophenate solutions (Dowicide H, Dowicide G, or Santobrite) for 20 seconds. Treated wood showed less than 3 per cent. stain after 5 weeks, compared with 55 and 72 per cent. stain on untreated wood. Dipping treatment does not give permanent protection, but is very useful for timber that has to be shipped before it is dry.

33.36.1 (73) : 31.42–3 : 33.52 : 33.53 : 33.31. **Report of Committee 17—wood preservation.** *Proc. Amer. Rly. Engng. Ass.* 45, 1944 (273–94). P.O. [328].

Reports are included on the following projects:—

(1) Service test records of treated wood, being mainly the tabulated results of the 1942 inspection of experimental ties in the tracks of the Chicago, Burlington and Quincy Railway; the ties, both treated and untreated, were laid in 1909 and 1910.

(2) Destruction by marine organisms and possible ways of prevention: a report giving the results of inspections of timbers in harbour and similar installations that are being tested under the supervision of the Committee with reference to damage by marine organisms.

(3) Specifications for creosote-petroleum mixtures. Appendix A is a specification for petroleum for blending with creosote.

(4) Destruction by termites and possible ways of prevention.

33.36.1 : 12.11.12. WILFORD, B. H. **Chemical impregnation of trees and poles for wood preservation.** *Circ. U.S. Dep. Agric.* No. 717, 1944. pp. 30. [Division of Forest Insect Investigations, U.S. Bureau of Entomology and Plant Quarantine.] [329].

This illustrated circular gives practical information on the preservative treatment by impregnation of trees and poles, based on the results of investigations made in North Carolina and South Carolina from 1930 to 1940, with a number of methods of treatment and 58 chemicals and chemical combinations applied at different seasons of the year.

33.36.1 : 33.54. STARKER, T. J. **Preservative treatments of fence posts: 1943 progress report on the Post Farm.** *Bull. Ore. Engng. Exp. Sta.* No. 9–E, 1944. pp. 6. [330].

Cf. *For. Abstr.* 5 (125). Further information is given on the series of posts representing different species and treatments that are under observation. The last posts of the White Fir (*Abies concolor*) group failed after 14 years, the average life for the group being 100 months. This species is not recommended for post material, because of its possible early failure, unless a considerable proportion of heartwood is included in each post.

33.36.1 : 33.31. GOUBANOV, T. A. **Defects in nitro-cellulose lacquer coatings on non-metallic surfaces.** *Civil Aviation, U.S.S.R.* 11 (5), 1941 (21). [Ministry of Aircraft Production, *R.T.P. Transl.* No. 1557. pp. 2.] I.F.B. [331].

Great care must be taken in the application of lacquer coatings to woodwork in aeroplanes to prevent pin-point bubbles forming in the lacquer; these permit the penetration of moisture, resulting in the premature decay of the wooden parts. The causes of pin-point bubbles are discussed in detail.

33.36.1 : 33.15 : 12.26–8. BROWNE, F. L., and SCHWEBS, A. C. **Moisture-excluding effectiveness of and weight of aircraft finishes on papreg and on plywood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1598, 1944. pp. 7 + tbls. P.R. [332].

Investigations were made of the finishing characteristics of papreg and of Yellow Poplar and Birch plywood, and of the effectiveness of

various finishing systems for these materials. The testing procedure and finishing systems used are described, and results are tabulated for the weight of finish and the moisture-excluding effectiveness for the direct-on-plywood and direct-on-papreg finishes tested.

33.36.2. *Fireproofing*

33.36.2 : 38.2. WICKETT, H. C. **Fire retardation in wooden structures.** *Aust. Timb. J.* 10, 1945 (543, 545, 547). [333].

Statistics show that in very few cases does the use of untreated wood increase the fire hazard. However, sheathing, proper construction and treatment with fire-retardants contribute greatly to the prevention of the spread of fires. Various types of fire-retardants are discussed and the comparative advantages of painting and impregnation are considered. Steel buildings are in no way immune to fire and can be an actual menace, as poorly insulated steel becomes plastic at about 500° F. Even if the materials of a structure are incombustible, fire may still be caused by inflammable articles contained in the building. Instances are given to illustrate the fallacy of the belief that there is any such thing as a completely fireproof building.

33.36.2. MCNAUGHTON, G. C., and VAN KLEECK, A. **Fire-test methods used in research at the Forest Products Laboratory.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1443, 1944. pp. 13 + tbls. + figs. P.R. [334].

This article describes, with illustrations, a number of fire-test methods (flame-spread and flame-penetration tests) in current use in investigative work at the U.S. Forest Products Laboratory, and indicates the variations in fire performance resulting from different kinds and degrees of fire-retardant treatment.

33.36.3. *Seasoning. Drying*

33.36.3 : 07.7. MOTTET, A. L. **The wind tunnel lumber dryer: possibilities and limitations.** *Timberman* 46 (2; 4), 1944-45 (44–6, 62, 64, 66; 114, 116, 118, 120). [335].

The wind tunnel lumber dryer consists essentially of a long tunnel with one or more fans at one end to force air lengthwise through the tunnel. The cross-stacked loads of lumber move progressively through the dryer from the 'green end' to the 'dry end' and the air flows in the opposite direction to the movement of the lumber. Drying temperatures are only a little higher than atmospheric, but the combination of small amount of extra heat with large volumes of air makes drying about 8 times as fast as average air drying. The advantages of this dryer are its extremly low first cost, economy of heat, and simplicity of operation. Its principal disadvantages are a longer drying time than in ordinary kiln drying, lack of close control of drying conditions, and lack of flexibility in operation. The article describes the dryer in detail and explains its operating characteristics in relation to drying of West Coast lumber. Air volume and heat requirements are calculated and various types of fan heating equipment are discussed.

33.36.3. **Wood drying by gas.** *Wood* 10, 1945 (92). [336].

Experiments were recently carried out in the drying, by means of gas ovens, of skeleton wooden frameworks which entail spliced joints and the use of special wood cement. Over a period of three months the results have been very satisfactory without a single failure. The oven is so designed that only the ends to be spliced are dried and the average loading is 100 cu. ft. of timber. The process takes 15 hours at a temperature of 70° F., gas consumption being quite economical, the average quantity used per load being 1·14 Therms.

33.36.3 : 33.15. SMITH, P. I. **Wood and radio frequency heating methods.** *Wood* 10, 1945 (32–3). [337].

The use of radio frequency heating as a practical alternative to normal conduction methods of heating is receiving close consideration in the wood and allied industries. In this article the two basic types of sets that are of interest to the wood-working industry are briefly described and the problems relating to their use discussed.

33.36.3. TIEMANN, H. D. **Significance of inherent stresses while drying lumber.** *Sth. Lumberm.* 169 (2129), 1944 (259–60). [338].

The article gives a summary description of the stresses set up in the process of drying timber, and describes the use of the pronged disk for determining stresses periodically during kiln-drying.

33.36.3. **Conditioning and storing of air-dried and kiln-dried aircraft stock.** *Mimeo.*

U.S. For. Prod. Lab., Madison No. 1370, (revised) 1943. pp. 2 + figs. P.R. [339].

Where dry kilns are not available it may be desirable to store and condition air-dried lumber in sheds or storage rooms at ordinary factory temperatures or a little higher. Rules to be observed under these conditions with respect to piling, air circulation, and temperature, humidity and moisture relations, are noted. Brief reference is made to the possible effect of such storage on defects.

33.36.3 : 34.6. **Drying sawdust by infra-red heating.** *Mech. World* 117, 1945 (6–7). P.R. [340].

Sawdust to be used in cleaning balls and rollers for bearings is dried more quickly and uniformly by passing it through the 'tunnel' of a G.E.C. infra-red lamp heating plant than by air drying. In addition, the infra-red heating volatilizes the resins, which may otherwise cause damage. The mechanism of the drying plant is described briefly.

33.37. Distillation. Manufacture of Tar

33.37 (54 : 71). GHOSE, T. P. **Softwood distillation in Canada and India.** *Indian For.* 71, 1945 (63–8). [Forest Research Institute, Dehra Dun.] [341].

Various experiments on the distillation of Pine tar have been made in Canada and India, and details are given of some of the findings. The author pleads for the retention of the Chir Pine (*Pinus longifolia*) tar industry in India, which is in danger of extinction for economic reasons.

33.37. HELLER, O. **Recovery of by-products of the manufacture of charcoal from wood and the like.** *British Patent* No. 563,906, 1944. Fuel Res. Summ. 8, 1944 (483). P.R. [342].

Acetic acid, tar, etc., are recovered from the vapours from wood distillation by washing the hot vapours with cooled pyroligneous acid liquor whereby acetic acid is absorbed in the liquor, and tar, etc., is condensed, and the heated liquor is then sprayed into an air stream, whereby the air is heated and saturated with acetic acid and water vapours, the acetic acid being recovered from the air by absorption in an alkali, while the cooled residual liquor is recirculated for the treatment of the distillation vapours.

33.38. Charcoal Manufacture. Use of Wood and Charcoal in Producer-Gas Generators

33.38 : 34.6. RIECK, H. G., LOCKE, E. G., and TOWER, E. **Charcoal I & II. Industrial fuel from controlled pyrolysis of sawmill wood waste.** *Timberman* 46 (2; 4), 1944–45 (49–50, 52, 54, 56, 58, 60; 96a, b, c, d, 97–8). 33.38 : 33.37 : 34.6. SCHRADER, P. G., CHRISTENSEN, B. E., and FRIEDMAN, L. **Charcoal III. Industrial tars from controlled pyrolysis of sawmill wood waste.** *Timberman* 46 (5), 1944–45 (56, 58, 60). [Oregon Forest Products Laboratory, Corvallis, Ore.] [343].

During the war the establishment in the northwest United States of electro-chemical and electro-metallurgical plants for the production of calcium carbide and ferro alloys has resulted in a demand for as much as 75,000 tons of charcoal a year. The manufacture of viscose rayon for the rubber industry requires about 0·25 lb. of charcoal for every 2·65 lb. of viscose rayon. In addition, large quantities of carbon disulphide are used as seed fumigant, weed eradicator and rodent exterminator, while large quantities of charcoal are needed in iron foundries, steel plants, etc. It was therefore necessary to determine the most economical method for the production of a charcoal which would have the specifications required by the known market.

The Oregon Forest Products Laboratory has undertaken various investigations to determine a means of producing charcoal from sawmill waste. A process of carbonization of wood waste in the form of sawdust, and the production of tar-bound charcoal briquettes are being developed. The products of the process, which embodies a horizontal, internally fired, rotary kiln, are charcoal, primary tar, pyroligneous acid, and gas. The best yield of a suitable charcoal, with a 13·2 per cent. volatile, was 25·8 per cent. based upon the weight of dry wood substance in the raw material. The maximum tar yield was about 25 per cent. of the weight of the charcoal produced. Optimum turnover for this 18-in. diameter kiln is about 120 lb. of sawdust per hour, and 16·7 hours would be required for the carbonization of a unit of sawdust. Satisfactory briquettes were produced in a rotary press and, after recarbonization, had an average specific gravity of 0·77, volatile 15 per cent., and a crushing

strength of 250 lb. The total cost to produce charcoal briquettes in a commercial 50-ton per day plant in southwestern Oregon at the source of raw material, is calculated at about $15·00 per ton, which includes the raw material at $4·50 per ton. The present 3 articles are based on research carried out in the development of this process. The first deals with carbonization of sawdust, the second with the preparation of charcoal briquettes, and the third with the study of the tars resulting from the pyrolysis of sawdust.

33.38.2 (54.2). DERRY, R. L. **Transport producer-gas charcoal manufacture and control.** *Indian For.* 71, 1945 (115–7). [Indian Forest Service.] [344].

An outline of the scheme formulated in August, 1944, at a meeting between forest officers and the Provincial Motor Transport Controller in Bihar to determine the degree of Government control necessary to ensure a reasonable output of suitable charcoal and to work out details with forest contractors and transport dealers for the satisfactory execution of essential requirements. Details are given on the decisions reached by the meeting on (*inter alia*) the standards required for a suitable charcoal, the price of graded charcoal, and the part to be played by the Forest Department and the Provincial Motor Transport Controller. Private owners or contractors will be allowed to come into the scheme provided they fulfil certain conditions.

33.39. Manufacture of Alcohol from Wood

33.39 : 34.6. JOHNSON, H. C. E. **Ethyl alcohol from wood waste.** *Chem. Industr., N.Y.* 55, 1944 (226–9). L.S. [345].

A brief illustrated account is given of the modified Scholler process for acid hydrolysis of wood to sugar and then, by fermentation, to ethyl alcohol, which has been developed at the U.S. Forest Products Laboratory. A project has been approved whereby a plant using this process for the production of industrial alcohol from wood waste is to be set up near Eugene, Oregon; the capacity of the plant will be 4 million gals. a year.

33.5. *Poles and Other Roughly Converted Wood*

33.53 (410) : 12.25 : 33.36.1. SNOW, C. F. F. **Home-grown telegraph poles.** *Wood* 10, 1945 (29–31). [346].

Scots Pine, Corsican Pine, Douglas Fir and Larch are the species most commonly used for telegraph poles, and supplies for Great Britain were formerly imported mainly from Canada and Scandinavia. During the war supplies have been obtained largely from thinnings of Forestry Commission plantations and from private estates. Care is needed in the growth of poles, for none must be more than 3 inches from the vertical. After felling, the outer bark and cambium are removed, and the poles are stamped, sorted and left to air dry for about six months. Subsequently they are treated with creosote in cylindrical tanks at a temperature of 150° F. and a pressure of 150 lb. per sq. in. The stay blocks and cattle guards for use with the poles are treated in the same way.

33.6. *Packing Boxes, Crates, etc.*

33.6 : 12.26–8. WESTERN AUSTRALIA. **Report on the operations of the Forests Department for the year ended 30th June, 1944.** Govt. Printer, Perth. 1944. pp. 12. [347].

Seasoned Jarrah (*Eucalyptus marginata*) has been used successfully as a substitute for imported softwoods in the manufacture of butter boxes. The boxes were sprayed on the inside with a casein formalin mixture and did not impart any taint or flavour to the contents (p. 9).

33.8. *Other Manufactured Products*

33.8 : 31.2 : 33.36.2. BOULTON, E. H. B. **Timber in shipbuilding.** *Repr.* from *Trans. Instn. Engrs. Shipb. Scot.* 1944 (16–45). [348].

A great deal of wood is still used in ship and boat building, and lifeboats built entirely of wood have proved more satisfactory than steel boats. The different species of wood used for different parts of a lifeboat are enumerated. Though fishing and cargo vessels are built principally of steel, a large quantity of timber is used in their equipment. With very few exceptions, wooden hatch covers are in general use on all ships of all countries. The advantages of wood for this purpose are safety in handling, interchangeability, facility for repair (especially in an emergency) and adaptability.

In recent years naval architects have used plywood and veneers in the construction of

interiors of ships, especially for bulkhead linings and ships' side-lining. It is said that every Victory ship contains the equivalent of over 30,000 sq. ft. of plywood of a thickness of ¼ in.

The Royal Navy has used fireproofed timber in its ships for many years and has proved its efficacy. Further large scale tests under very stringent conditions are now in progress. Steel, which is popularly regarded as entirely fireproof, loses about half its strength at 900° F., and by twisting and bending may distort steel structures out of position. Concrete disintegrates under the effects of fire. The temperatures of fires on board ships are sufficiently high (1200°–1800° F. or more) to cause severe buckling or worse of steel beams, fitments, etc. The advantage of timber is that it will not buckle or lose its strength until the cross-section of the wood is reduced below a certain minimum. The advantage of fireproofing is that it delays to an enormous extent the disintegration of the wood in a fire. Wood has a very low conductivity of heat, which helps to preserve the contents of wooden cupboards and other containers, which are unaffected by any serious degree of heat until the timber is burnt through, whereas with metal the heat is rapidly transmitted and papers, etc., are charred at a comparatively early stage. Of the two general methods of treating wood to render it fire-resistant, impregnation under pressure is far more effective than surface painting, but fire-resistant paints have proved effective even against incendiary bombs; their greatest value is that they prevent immediate ignition and so allow fire-fighters time to deal with the outbteak.

The paper concludes with notes on some of the ornamental woods used in shipbuilding. [See also *Sth. Lumberm.* 169 (2129), 1944 (116–117).]

33.8. **Wood pulp used for smokeless powder.** *Sth. Lumberm.* 170 (2151), 1945 (58). [349].

A new sulphate nitrocellulose process has been developed for use in the manufacture of smokeless powder from wood pulp. Low-grade southern Pine wood is the raw material used in this process, virtually unlimited supplies being available.

33.8 : 33.15 : 12.26–8. HOUSTON, J. **Dust exhauster fans.** *Wood* 10, 1945 (74–5). [350].

The article gives an account of dust extracting plants made of Birch plywood, which have proved very satisfactory and can be made by any competent joiner. A description is given of a centrifugal fan of Birch plywood and a wooden dust pipe of rectangular section which proved more satisfactory, as well as being much easier to construct, than the usual circular pipe.

33.9. *Grading and Storage of Converted Timber*

33.91 : 12.25 : 98.3 (81). **Parana Pine. The Brazilian Government's regulations for the classification and inspection of wood for export.** *Timb. Tr. J.* 170, 1944 (293-4). [351].

Details of the Government of Brazil Decree Law No. 5714, of May 27, 1940, for the classification and inspection of Brazilian Pine wood for export with a view to its standardization.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.2. *Vegetable Products*

34.21. Fodder Grass and Grazing

34.21 (76.3) : 97.3. CAMPBELL, R. S. **Grazing cattle on southern Pine forests.** *Sth. Lumberm.* 169 (2129), 1944 (188–91). [352].

The Southern Forest Experiment Station, in co-operation with the Louisiana Agricultural Experiment Station, recently completed a study based on interviews with 118 farmers who graze beef cattle on forest range at some time during the year. The farmers reported that when ranges are moderately stocked, cattle do little damage to Pine seedlings, and that cattle grazing reduces the fire hazard by an average of 27 per cent. Opinion was almost unanimous that indiscriminate burning damages both trees and forage, but carefully prescribed burning in the Longleaf Pine type improves grazing as well as reducing fire hazard.

There are 3 main types of grazing operations: (1) year-long forest range grazing with supplementary feeding in winter; (2) long-season forest-grazing in spring, summer and autumn, with grazing on farm pastures or cover crop and necessary supplementary feeding in winter; (3) short-season forest grazing in spring and early summer, with cattle on other types of forage for the rest of the year.

Farmers estimated an average reduction of

2·5 per cent. a year in grazing capacity as the canopy of a fully stocked stand closes over, but cuttings and fire lanes can be maintained to furnish a continuous base on which to carry the herd. Further research is needed on the joint problems of forest and herd management.

34.24. Tanning Materials. Cork

34.24 : 12.26–8 (72) : 12.19. Gooch, W. L. **Survey of tannin resources in Mexico.** *J. For.* 43, 1945 (56–8). [353].

A mission was sent to Mexico from the United States in December, 1943, with instructions from the Foreign Economic Administration to make a forest survey of Buttonwood (*Conocarpus erecta*) which grows along the Gulf Coast of Mexico, and to observe the occurrence of Red Mangrove (*Rhizophora mangle*) and Fustic (*Chlorophora tinctoria*), which have possible value in the tannin and dyewood industries.

Buttonwood occurs in a strip 10 to 20 miles wide along the coast in the States of Veracruz, Tabasco, Campeche, and Yucatan, in scattered patches varying from a few acres to several hundred acres in size, and also in a fringe along lagoon and sea shores. It attains its best development in a narrow belt just inside the Mangrove swamps. The tree is short bodied and very crooked and commonly lies in an almost prostrate position because of the failure of the very shallow root system to support the trunk when the ground is waterlogged. Buttonwood is a prolific sprouter from the stump, growth of sprouts being moderately fast. The growth rate of seedlings could not be accurately determined because of overlapping of growth rings, but other evidence indicates that it takes about 20 years for Buttonwood to reach 8 in. in diameter. The dark olive-brown heartwood is high in tannin content as is also the comparatively thin bark. The main local use for Buttonwood in Mexico is charcoal; it is one of the few woods which, when carbonated, will burn with little or no smoke. It is very durable in the ground and is employed for posts, fencing and telegraph poles. The more commercially promising areas of the species were found in the states of Tabasco, Campeche, and Western Yucatan.

Extensive areas of Red Mangrove were found along the Mexican Gulf Coast. The bark of this tree contains between 20 and 40 per cent. tannin. The best stands were located on the Tonala and San Pedro Rivers in Tabasco and Campeche. There is little exploitation except in a minor way for fuelwood and local house construction. The bark is used for tanning by natives along the coast. Red Mangrove is generally more accessible than Buttonwood, since it is close to water navigable throughout the year by small boats.

The Fustic tree has in the past been much used for dyeing, and large quantities have been exported, but with the introduction of chemical dyes this trade has fallen off considerably. A little Fustic is still used in Mexico for the manufacture of ink. The tree is scattered throughout the coastal plain, associated with Sapote (*Lucuma mammosa*) and other species. Its distinguishing characteristics are a smooth gray bark, angular branching with many spines on branches, and the distinctive yellow heartwood which is used for dye.

The final report of the mission, including maps, tannin analyses and other data, will be released as a public document in the near future.

34.24 : 12.25. Potter, E. F., Williams, K. T., Swenson, T. L., and Feustel, I. C. **Tannin extract from Western Hemlock bark.** *Industr. Engng. Chem.* (*Industr. Ed.*) 36, 1944 (1146–9). [Western Regional Research Laboratory, U.S. Department of Agriculture, Albany, Calif.] [354].

The bark of Western Hemlock (*Tsuga heterophylla*) is an important source of tanning materials. Much of the bark available for this purpose is a by-product from the manufacture of wood pulp, logs for which are commonly floated to the mill. While in the water, the bark loses the more soluble tannins by leaching, and bark of logs floated in sea water becomes impregnated with salt.

In this article an improved process is suggested for the preparation of tannin extract from the bark of floated logs. Bark prepared for extraction in a horn-angle hydraulic press required only 4 hours for leaching and the material did not pack or channel in the experimental leaching vats. The solubility of the tannin extracts was increased by treatment with sodium bisulphite.

34.24 (73) : 12.26–8 : 23.24. Cooke, G. B. **Cork culture in the United States.** *Sci. Mon., Wash.* 58, 1944 (357–64). P.O. [355].

Although the planting of trees for cork production in the United States had been

advocated by Thomas Jefferson as early as 1787, it was not until about 1858 that the United States Government first became interested in the introduction of the Cork Oak (*Quercus suber*) and imported acorns from Spain for distribution in the southern States and in California. Many of the young trees from this planting died, but some of those that survived are to-day magnificent specimens. Other plantings of Cork Oak have been made from time to time with varying results. Under a scheme sponsored by the Crown Cork and Seal Company many thousands of young Cork Oak trees have recently been planted in various locations from California to Florida. It is planned to plant not less than a quarter of a million trees per year. At present California has a larger number of Cork Oaks than any other state. Experimental plantings are being made in various types of soils and in locations having different conditions of rainfall, drainage and sunshine. The quality of the cork taken from trees in selected areas of the United States is excellent. Experiments are at present in progress on various aspects of cork culture.

34.24 : 12.26–8 (79.4) : 23.23.15 : 23.24.1 METCALF, W. **Growing Cork Oak (*Quercus suber*) in California.** *Proc. 10th west. Shade Tree Conf.* 1943 (62–8). [356].

The United States requires about 150,000 tons of cork a year, all of which comes from the 5 million acres of Cork Oak forest in Spain, Portugal and North Africa. Experimental stripping of Cork Oaks in California has shown that the cork produced is as good as any virgin cork received from Europe, and an extensive programme of planting is in hand. A method of storing the acorns at 38° F. has been worked out, under which they will keep for 4 months and then germinate rapidly enough to be ready for planting in 6 weeks. The advantage of this procedure is that it is not necessary to prune the tap root or allow it to become twisted in the container. The use of 10-in. or 12-in. deep tar-paper pots which can be planted directly in the field will also lessen shipping weight and facilitate handling.

34.25. Christmas Trees. Medicinal Plants. Edible Plants

34.25 (78.6) : 76.2. LOY, E. C. **Added income from Christmas trees.** *Soil Conserv.* 10, 1944–45 (197–8). [357].

The production of Christmas trees has become a major industry in Montana. The Soil Conservation Service has been assisting farmers in establishing a system of tree farming. Good progress has been made, and the larger number of Christmas trees are now cut according to recognized sustained-yield practices.

34.25 : 12.26–8 : 12.19. CARVALHO, A., and KRUG, C. A. A quineira (*Cinchona* sp.). Origem, classificação exploração economica no mundo e tentativas de sue aclimatação no Brasil. **[Quinine (*Cinchona* sp.). Origin, classification, economic distribution in the world and experiments for its adaptation to Brazil.]** Instituto Agronomico, Brasil. 1944. pp. 141. [Port.] Biol. Abstr. 19 (5297). [358].

A complete report on the quinine plant with regard to its possible growth in Brazil, including an account of the various expeditions into the Andes to study it. Other sections deal with the botanical characters of the plant and the various species, geographical distribution, and requirements for growth. Considerable attention is given to the actual centres of production over the world, including the Netherlands Indies, parts of the British Empire, the Philippines, and many others. Sections on cultivation of the plant include propagation by seed, grafting and cuttings, cultural methods, harvesting, and preparation of the bark. Information is given also on the distribution of the alkaloid in the plant, extraction of quinine, and pests. A final chapter deals with the problem of malaria in Brazil.

Introductions of *Cinchona calisayana* into Brazil were made in 1868 in one place in the State of Minas Gerais and two in the State of Rio de Janeiro. One of these plantings was still flourishing in 1938. There are no existing plantings of *C. succirubra* known in Brazil at this time. An introduction of this species was made in 1925, but all the plants died within a short time. Although early tests were not encouraging, studies are now being conducted on a large scale by the Agronomic Institute of Campinas for the acclimatization of *Cinchona* in Brazil.

34.25 : 31.3 : 12.25. FRYKHOLM, K. O. **Bacteriological studies of pinosylvine, its monomethyl and dimethyl ethers, and toxicologic studies of pinosylvine.** *Nature, Lond.* 155, 1945 (454–5). [Department of

Industrial Hygiene, Institute of Public Health, Stockholm.] [359].

Investigations on the bactericidal effect of pinosylvine (*trans*-3 : 5 dioxystilbene, $C_{14}H_{12}O_2$), and its monomethyl ether (*trans*-3-oxy-5-metoxystilbene, $C_{14}H_{11}O(OCH_3)$) extracted from Pine heartwood, revealed that both substances were much more toxic than phenol to the bacteria used in the test, pinosylvine itself being definitely stronger than its monomethyl ether. Pinosylvine dimethyl ether had no demonstrable bactericidal effect.

34.25 : 12.11.11 : 12.26–8 (729.5) : 45.3. PLANK, H. K. **Insecticidal properties of Mamey and other plants in Puerto Rico.** *J. econ. Ent.* 37, 1944 (737–9). [U.S.D.A. Federal Exp. Sta., Mayaguex, Puerto Rico.] [360].

Investigations have been made on the toxicity of the above-ground parts of plants other than *Derris* and *Lonchocarpus* growing in Puerto Rico against certain insect pests, including adults of *Cerotoma ruficornis* and larvae of *Diaphania hyalinata*, *Laphygma frugiperda* and *Plutella maculipennis*. The most outstanding results were obtained from the mature seeds of Mamey (*Mammea americana*), a tropical tree species of the Guttiferae family, and of the Yam Bean (*Pachyrhizus erosus* var. A.). Data are given on the toxicity of the seeds and other parts of these two plants. The action of Mamey seeds seems to be that of a contact poison. The relatively high toxicity of the seeds to phytophagous insects, the ease of preparation and application of the insecticide and the availability of seed-bearing trees, make *Mammea americana* a promising source of insecticidal material.

34.26. Resin. Gums. Turpentine. Oils. Rubber. Latex. Dyestuffs. Sugar

34.26 : 12.25 : 43.3. HARPER, V. L. **Effects of fires on gum yields of Longleaf and Slash Pines.** *Circ. U.S. Dep. Agric.* No. 710, 1944. pp. 42. [Division of Forest Economics, U.S. Forest Service.] [361].

The effects of three types of burning on the gum yield of Longleaf and Slash Pine (*Pinus palustris* and *P. caribaea*) were studied, the treatments consisting of: (1) Removal of the dead and living vegetation cover of the soil by surface fire; (2) defoliation of the trees by (*a*) heat-killing of the needles as in a hot ground fire, and (*b*) burning of the needles as in a mild crown fire; (3) scorching the stems of trees, as (*a*) in an ordinary face fire, and (*b*) in a very severe crown fire.

(1) Burning of the ground vegetation increased the gum yield from Longleaf Pines by about 4 per cent. during the succeeding year, while the yield during the second year after the fire appeared to be little affected; it is believed that similar results can be expected with Slash Pine.

(2) The gum yield of both species was decreased by as much as 19 per cent. during the first year following heat treatment that killed the needles, and by up to 64 per cent. following flame treatment (as in a mild crown fire). Under both kinds of treatment the decrease in yield varied with the degree and season of defoliation. Yields were approximately normal during the second year after the treatment.

(3) Stem scorching caused no serious reduction in yield except in the case of a particularly heavy crown fire. Such a fire, which killed outright, or caused subsequent death of, 50 per cent. of the turpentine trees, injured the stems of 32 per cent. of the surviving trees to an extent that necessitated permanent abandonment of the existing faces.

Results of this study indicate that it is wise to defer turpentining for 1 year after a mild crown fire and for 2 years after a heavy crown fire. *From author's summary.*

34.26 : 12.25 (75 : 76). GUENTHER, E. **Oil of Cedar wood.** *Soap sanit. Chem.* 19, 1943 (94–7, 109). P.O. [362].

The red heartwood of *Juniperus virginiana* L. contains a useful oil, the main constituent of which is cedrol, a tertiary tricyclic alcohol ($C_{15}H_{26}O$). Prior to 1917 the main source of Cedar wood oil was the old virgin timber used by pencil slat manufacturers. Later, owing to scarcity of this material, the oil had to be distilled more and more from sawdust of younger trees, and at the present time it is obtained almost exclusively from shavings and refuse in the processing of Cedar boards and shingles. The yield of normal oil from fresh chips and dust averages 2 to 2·5 per cent. As the proportion of heartwood to sapwood increases with the age of the tree, Red Cedars should not be felled before reaching the age of 25 years. Heartwood from either second-growth or virgin Cedar contains approximately the same amount of oil.

Because of its relative abundance and low cost Cedar wood oil is itself seldom adulterated, but it is frequently used to adulterate more expensive essential oils. Means for its detection are indicated.

Data are given on the composition and properties of the oil of *Juniperus virginiana*, and a note is added on recent developments in the distillation of so-called Cedar wood oil from *Thuja occidentalis*. The physico-chemical properties of this oil are quite distinct from those of Red Cedar oil.

34.26 : 12.14.8 : 12.25. PAJARI, K. **The bark and the oil of the bark of *Pinus sylvestris*.** *Ann. Acad. Sci. fenn.* 59A (6), 1942 (7–160). *Chem. Zbl.* I, 1943 (1897–8). Chem. Abstr. 38, 1944 (4648). O.R.S. [363].

By means of petroleum ether a dark green oil was extracted from dried and ground bark, and its physical properties and chemical characteristics were determined. The bark oil contains more free acid than is usual in fats and oils, a great quantity of esters, and a large proportion of unsaturated compounds.

34.26 (7 : 8). GUENTHER, E. **Essential oils and their production in the Western Hemisphere.** Fritzsche Brothers, Inc., New York. 1942. pp. 30. [364].

In this popular account of the plants of the western hemisphere from which essential oils are obtained on a commercial basis, reference is made to the following forest trees: Rosewood (*Aniba rosaeodora* var. *amazonica*) and Copaiba (*Copaiba* spp.) from the Amazon basin; *Bulnesia sarmienti* from the Gran Chaco of Paraguay; *Myroxylon pereirae* ('balsam Peru') from El Salvador; *Bursera aloexylon* from Mexico; and *Betula lenta*, *Sassafras albidum*, *Juniperus virginiana*, and *Pinus* spp. from the United States.

34.26 : 12.26–8 (81). GUENTHER, E. **Brazilian Sassafras oil.** *Drug Cosmetic Ind.* 55, 1944 (538–9, 620–1). L.S. [365].

Brazilian Sassafras oil is distilled from the wood of *Ocotea pretiosa* Benth., a tree species found abundantly along the River Itajai in the State of Santa Catarina, as well as in other parts of Brazil and elsewhere in South America. Only sufficiently old trees (40–50 years old) give a good yield of oil, and the heavy exploitation of accessible stands in the Santa Catarina area (due to the recent high demands for oil) has necessitated penetration into less accessible areas in the search for suitable trees and has led to a consequent increase in transportation costs.

Brazilian Sassafras trees appear to give different yields of oil according to the colour of their wood. Black Sassafras wood is said to yield about 1·5 per cent. of oil, brown wood 1·2 per cent., and yellow wood about 0·9 per cent.

The properties of the Brazilian oil are indicated. Good Sassafras oils should have a safrol content of at least 90 per cent. The Brazilian oil contains less terpenes than the North American official Sassafras oil which is obtained from a different species, *Sassafras albidum* (Nuttall) Nees. The oil of *Ocotea pretiosa* has not yet been admitted by the U.S. Pharmacopoeia.

34.26 : 12.26–8 (97). **The present position of tung oil production in the Empire.** *Bull. imp. Inst., Lond.* 43, 1945 (14–8). [366].

In the Union of South Africa it was calculated in 1944 that there were 130,000 Tung trees in Natal and Transvaal and 100,000 in Swaziland. The crop in 1943 yielded 270 tons of oil. Research work on Tung cultivation is being undertaken at the Sub-tropical Horticultural Research Station, Nelspruit, Transvaal. A mill for crushing the seed has been established at Germeston.

Cultivation trials have been carried out in Kenya, Tanganyika, Northern Rhodesia and Uganda. The results obtained were reviewed at an Agricultural Research Conference held at Amani in 1936. There are 100 acres under *Aleurites montana* at Amani and they are reported to be making satisfactory progress.

Considerable progress has been made towards the establishment of a Tung oil industry in Nyasaland. Cultural experiments are in progress at the Tung Experiment Station at Chisawana, Cholo. *Aleurites montana* is proving more successful than *A. fordii*, which was the species originally introduced. The acreage under Tung trees in 1943 was 6,847 acres. The Nyasaland Government is investigating the growing of Tung trees by natives in the Northern Provinces.

A number of experimental trials have been made in various parts of India, particularly in Assam, Bihar, Bengal, Coorg and Mysore. *A. fordii* has been successfully grown on small acreages in Assam and Bihar; *A. montana* appears to be better suited to climatic conditions in the other districts named.

Quite promising results have been obtained

in Burma where, by the end of 1939, there were 10,000 acres under Tung trees. *A. montana* is the more favoured species.

In 1940 there were between 500 and 600 growers of Tung in New South Wales and Queensland, with some 250,000 trees planted. Experiments are being made by Queensland Forests Ltd. in the possibilities of growing the multi-cluster type of *A. fordii* on a commercial scale.

Tung cultivation has been unfortunate in New Zealand, probably owing to the planting of trees on poor soil and in unsuitable localities. The Tung oil companies started planting without awaiting for the results of experimental plantings and by 1936–7 a peak of 5,577 acres was reached, which in January, 1942, had declined to 29 acres.

34.26 : 12.26–8 (67.2 : 66.7 : 66.9). **Isano oil.** *Bull. imp. Inst., Lond.* 42, 1944 (250–3). [367].

As a result of the shortage of paint and varnish oils caused by the war, considerable attention has been given in recent years to the possible use of oils not hitherto exploited commercially. This article gives a resumé of the information available in published literature on the properties and possible uses of the oil obtained from the fruit of Isano (*Ongokea klaineana*), a tree 8–9m. in height. This species occurs widely in the French and Belgian Congos, and is also found in Nigeria and the Gold Coast, but not in sufficient numbers to make commercial exploitation of the oil possible. In the event of a demand for this oil, supplies would probably be made available in French Congo. It is understood that the kernels from which the oil is obtained do not travel well, so that it may be necessary to prepare the oil in the country of origin.

34.26 : 12.26–8 (6) : 12.19. Esdorn, I., and Nolde, I. Die fettliefernden Bäume und Sträucher des tropischen Afrika. [**The fat-producing trees and shrubs of tropical Africa.**] *Beitr. z. Kolonialforsch.* 4, 1943. Reviewed in *Dtsch. Heilpfl.* 10, 1944 (7–8). Hort. Abstr. 14, 1944 (1333). [368].

In this detailed monograph of fat-producing plants in tropical Africa, 179 different plants from about 40 families are described and partly illustrated. The distribution of *Butyrospermum parkii* in Africa is recorded in a map.

34.26 : 12.25. Max, K. W. **A study of tall oil from green and seasoned Slash Pine-wood.** *Sth. Pulp Paper J.* 7 (8; 9), 1944–45 (9–13, 28–31, 32; 22–4, 26, 28). [369].

Wood of Slash Pine (*Pinus caribaea*) was used for the purposes of this study. Half of every log was seasoned for 4 months and the other half used green. The precursors of tall oil (the ether extractives) were extracted from both seasoned and green wood in sufficient quantities and tall oil was also prepared from both classes of wood by sulfate pulping. The four fractions were then analysed and compared. A complete analysis of the wood and extractives of green Slash Pine is given. The properties of tall oil are largely dependent on the degree of seasoning of the wood. Tall oil from seasoned wood shows decreased unsaturation, increased average molecular weight, accentuated physical properties and increased colour. Tall oil from both green and seasoned timber is comparatively richer in fatty acids and poorer in rosin acids than the ether extractives. Green wood extractives are not lost during cooking and isolation of tall oil to as great an extent as are seasoned wood extractives.

There are numerous variables affecting the yield and quality of tall oil; age, proportion of heart- and sapwood, species, degree of seasoning exert a direct influence on the resulting tall oil and conditions of pulping also have a direct effect. *From author's summary.*

34.26 : 12.14.7 : 12.26–8. Chatterji, N. G. **Industrial utilization of Mahua.** *J. sci. industr. Res., India* 3, 1944 (265–7). I.H. [370].

The Mahua trees of northern and southern India (*Bassia latifolia* and *B. longifolia* respectively) produce flowers which contain, when fairly dry, about 60 per cent. of sugars consisting mainly of sucrose and invertose, as well as seeds rich in a good quality of oil which is now used principally in soap-making, but which could be refined and deodorized to produce a good edible oil. In the present article the author proposes a suitable method for the manufacture of alcohol from Mahua flowers; it is estimated that the potential supply is about 3·25 million gals.

34.27. Seeds. Fruits. Leaf Fodder

34.27 : 12.26–8 (45.2). Chaturvedi, M. D. **The role of leaf fodder in animal husbandry of the United Provinces.** *Indian For.* 71, 1945 (13–6). [371].

During cold weather, when grasses become increasingly tough and inedible, leaf fodder helps out the food resources of some 12 per cent. of the domestic animals in the United Provinces. Introduction of leaf fodder species, such as *Adina cordifolia*, *Bauhinia variegata* and *Morus alba*, and effective control of lopping will do much to increase this important supply of food. A table is given showing that, compared with grasses, leaf fodders of the above species are exceptionally rich in such essential nutrients as crude proteins, nitrogen-free extractives, crude fats and lime. It is difficult, however, to generalize on their nutritive value owing to the lack of data regarding digestive trials.

34.6. *Utilization of Logging and Milling Waste*

34.6 (68.9) : 33.0 : 33.36. WILKINSON, T. L. **Utilization of forests. Saving trees by rendering utilization more complete.** *Repr.* from *Rhod. agric. J.* 41, 1944 (398–406). [*Bull. Dep. Agric. S. Rhod.* No. 1281, 1944. pp. 9.] [372].

This article, which is a plea for the more efficient use of the forests of Southern Rhodesia as a means of conservation, is to be read in conjunction with an earlier paper by the same author on 'The Management of Indigenous Woodlands' [cf. *For. Abstr.* 6 (263)]. Points particularly stressed in the present article are the need for proper seasoning of both fuelwood and constructional timber, and the use of preservatives.

34.6 : 33.32 (71). **[Reports of committees of the Technical Section, Canadian Pulp and Paper Association.] Report of the Waste Committee. With appendixes: A. The barking of tree tops,** by J. Mck. Limerick. **B. Progress report on conversion of waste wood into usable fibre by the Asplund process and further refining,** by J. W. Church. **C. Sawmill waste material,** by R. R. Duffy. *Pulp Paper Mag. Can.* 46, 1945 (270, 272, 274). [373].

A brief report on studies dealing with the utilization of tree tops [cf. *For. Abstr.* 7 (78)] and sawmill waste. Results to date indicate that: (1) Equipment at present available for barking logs has not been developed to the point where it can handle small wood such as tree tops. (2) Where pulp is not subsequently bleached, and if dirt is not important, unbarked tree tops can be successfully cooked by the sulphate process; knot rejections may be slightly higher in such pulp. (3) Fibre, which is of potential value to the boxwood industry, can be produced by the Asplund process from saw and planer mill waste. Data are given to indicate the quantities of waste of sound wood material incidental to an efficiently-run sawmill operation.

34.6 (71.1) : 12.25 : 32 : 33.32. BRITISH COLUMBIA. **Report of the Forest Branch for the year ended December 31st, 1944.** King's Printer, Victoria, B.C. 1945. pp.79 + plates. [374].

The first phase of the experiment undertaken in British Columbia to find a means of economically utilizing the sound wood which constitutes part of normal logging waste [cf. *For. Abstr.* 6 (110)] has been completed with the delivery and conversion to newsprint paper of the equivalent of 2 million bd. ft., consisting of 68 per cent. Hemlock, 26 per cent. Douglas Fir, 3 per cent. White Pine, and 3 per cent. Red Cedar. Thus far the experiment has indicated: (1) the desirability of a uniform product (particularly with respect to loading operations); (2) that board-measure scale fails to give an adequate measure of the wood that may be recovered—cubic measure has, therefore, been adopted for the experiment; (3) the necessity of handling the material with a minimum of operations; (4) that machinery, both in the woods and conversion plants, must be specially designed or adapted.

The material recovered has been converted to groundwood pulp; the strength qualities of the pulp were below those for normal wood and the dirt-making properties of the salvage logs were about three times those for normal pulp logs. Wood density and hence pulp yield was higher for both salvage Hemlock and Douglas Fir than for normal Hemlock logs. With the present type of wood preparation plant the salvage material has an advantage over normal supplies with respect to production costs.

34.6 : 33.3 : 33.15. STAMM, A. J. **Chemical utilization of wood waste and the development of improved wood products.** *W. Cst. Lumberm.* 72 (2), 1945 (74, 76, 79–80). [U.S. Forest Products Laboratory, Madison, Wis.] [375].

This conference paper reviews the more important subjects of chemical research at the

U.S. Forest Products Laboratory. Wood hydrolysis to form sugars, followed by fermentation to alcohol, is at present being given chief emphasis. A modified cyclic percolator has just been developed, which combines the high yields of the German Scholler process with the speed of the old American process. Yields of 50 to 60 gals. of 95 per cent. ethyl alcohol per ton of clear waste softwood have been obtained. Another means of obtaining ethyl alcohol is fermentation of the sugar portion of sulphite waste liquor in the presence of lignin. A slight modification of this process is to be used in a new recovery plant of the Puget Sound Pulp & Paper Co., at Billingham, Washington. It is expected that about 18 gals. of 95 per cent. alcohol will be produced from the 2,000 gals. of waste liquor resulting from the making of a ton of pulp. This is about half the theoretical yield.

So far lignin residue from the complete hydrolysis of wood has defied use as a plastic, but if wood is only partially hydrolyzed the resulting residue can be used in conjunction with other plastics such as phenol-formaldehyde to form high-grade plastics. Because of the economy of phenolic resin and an improved acid resistance, this substance, which has been called hydroxylin by the Forest Products Laboratory, should find a considerable use, especially in the moulding of larger objects. Similar saving of phenolic resin is effected in laminated sheets.

It has been shown that lignin dissolved in organic solvents or suspended in water can be made to react with hydrogen gas at elevated temperatures and pressures in the presence of various metallic catalysts. New cyclic alcohols that have never previously been described, are produced. These show promise as plastic solvents, antiknock agents for motor fuel, and toxic agents. By varying the hydrogenation conditions, phenolic compounds which may find use in plastics, together with a plastic-like residue, are obtained. Wood waste or chips can also be hydrogenated in aqueous suspension to produce soluble lignin decomposition compounds and a cellulose pulp residue. This is a possible new pulping process that deserves further study. Under more severe hydrogenation conditions, the cellulose can be converted to glycerine and related compounds. In this case the entire wood is converted to liquid products.

The paper goes on to give some account of various 'improved' woods. Two simple non-resin treatments for wood are now at a stage of development which shows promise of dimensionally stabilizing wood to a greater degree than is possible by the use of resins. One of these causes no embrittlement of the wood even when uncompressed. It is felt that these treatments may in time replace the present resin treatment for many purposes. Notes are given on Papreg, a paper-base laminate, paper-faced plywood, and the treatment of light paper board material with resins. [See also *Timberman* 46 (4), 1945 (79–80, 82, 84)].

34.6 : 31.3. OREGON. **Biennial report of the State Forester to the Governor, July, 1942, to June 30, 1944.** Oregon State Board of Forestry, Salem, Oregon. 1944. pp. 63. [376].

Experiments undertaken at the Oregon Forest Products Laboratory on the utilization of wood waste have been concerned mainly with lignin, and results indicate that it may be used: (1) As a fuel—calorimetric tests show it to have a value slightly higher than the average for Douglas Fir wood. The lignin may be briquetted and used directly for domestic fuel; it is readily carbonized, with a considerably higher yield than wood of both charcoal and tar. (2) As an extender; as a conditioner for orchard dusting compounds, as a soil lightening and acidifying agent, as a carrier for fertilizer and for extenders in plastics and resin adhesives. (3) In plastics; if suitably modified, lignin may form a basis for a desirable plastic compound or resin adhesive (pp. 38–40).

34.6. VORREITER, L. Handbuch für Holzabfallwirtschaft. [**Handbook on the utilization of wood waste.**] Verlag J. Neumann, Neudamm. 2nd ed., 1943. pp. xii + 519. [G.] [377].

A comprehensive work dealing with the utilization of the four main types of wood waste: (1) waste in the forest; (2) industrial waste; (3) wood rejected on account of defects; and (4) used timber. Chapters are included on methods of reducing the amount of waste; the nature and properties of waste wood; and the preparation and use of waste wood. In addition to its direct use in the manufacture of small articles, wood-fibre boards, cellulose pulp, spinnable fibres, etc., waste wood is useful as a fuel and may also yield valuable secondary products in the form of oils and resins, dyes,

tannins, wood sugars and other extracts. A section is included on these products and on the carbonization and gasification of wood waste.

34.6 : 33.06 : 33.3. **Wartime status of sawdust, shavings, and other wood waste as commercial raw materials.** *Mimeo. U.S. For. Prod. Lab., Madison* No. *R*1450, 1944. pp. 5. P.R. [378].

A brief description is given of industries which under favourable economic conditions can serve as outlets for surplus sawdust, shavings, and other forms of wood waste. These include the production of wood plastics, ethyl alcohol, yeast, roofing felts, wood flour, fuel and pulp.

34.6 (73) : 33.32. DORLAND, R. M. **The hydrolysis of lignocellulose: The Masonite process in the war effort.** *Chem. Engng. News* 22, 1944 (1352–6). L.S. [379].

38. FOREST CONSTRUCTIONAL WORKS. ENGINEERING

38.2. **Heavy timber construction details.** *Wood Utiliz. Data nat. Lumb. Mfrs. Ass.* No. 4, 1943. pp. 16. I.F.B. [380].

Details are given in a series of drawings of practical heavy timber framing, both floor and roof framing, showing clearly the types of connections used in all cases.

38.2. **Timber connectors design and load data. Manual of timber connector construction.** *Wood struct. Design Data nat. Lumber. Mfrs. Ass., Suppl.* No. 6, 1940. pp. 14. I.F.B. [381].

4. FOREST INJURIES AND PROTECTION

4 : 01.6. GÖRG, F. Die wichtigsten Arbeiten auf dem Gebiete des allgemeinem Forstschutzes seit dem Jahre 1938. **[The most important works on general forest protection since 1938.]** *Thar. forstl. Jb.* 93, 1942 (687–99). [G.] [382].

A list of important works on forest protection arranged under the following headings: (1) Storm—wind; (2) snow—ice—rime; (3) frost; (4) forest fires; (5) smoke; (6) die-back of Fir; (7) wild life; and (8) other factors.

42. INJURIES FROM INORGANIC AGENCIES, EXCLUDING FIRE

42.1. *Air Currents*

42.1 (43.7) : 22.83.2 : 23.21 : 12.25. HEGER, A. Waldbauliche Planung und Forstschutz. **[Silvicultural planning and forest protection.]** *Thar. forstl. Jb.* 93, 1942 (555–86). [G.] [383].

Methods are discussed whereby new plantations on sites liable to storm damage (particularly the marginal hills of the Sudetenland) are afforded maximum protection against wind. Greatest damage has been suffered in the pure, even-aged Spruce plantations which have replaced the more storm-resistant native mixed forests. The author claims that no highly organized community is based on the principle of similarity, and that dissimilarity in composition and age is an important factor in reducing storm damage. He therefore favours the establishment of uneven-aged, mixed stands. The original vegetation of the Spruce areas of the Sudetenland consisted mainly of a comparatively wind-firm forest of Beech, Fir and Spruce. Although the choice of species for new plantings should be based as far as possible on the natural flora, an exact reproduction of the original vegetation is not generally expedient. The species used will depend to some extent on national requirements. An essential preliminary to forest planting will be the provision of adequate, well-placed roads. The provenance of the planting stock will also be of the highest importance. The place of Silver Fir, Sudeten Larch, Scots Pine and Spruce in the schemes for afforestation is discussed, and some of the measures to be taken to prevent or reduce storm damage are reviewed. These include the provision of marginal shelterbelts and the distribution of storm-resistant species, such as Beech, in groups or rows throughout the stand. Above all, the stand must take on an uneven-aged character, since storm-resistance increases with increased stratification. The ultimate aim of reforestation should be the creation of selection forest.

42.2. *Temperature Influences*

42.21 : 21.64. UNITED STATES. **Annual report, 1944: Northeastern Forest Experiment Station.** Northeastern Forest Experiment

Station, Philadelphia, Pennsylvania. [1945.] pp. 52. [384].

The northern hardwood forests of the Allegheny are characterized by many openings 3–100 acres in size on which second-growth timber fails to develop. Investigations have shown that few if any openings of this type exist in virgin forest stands and that where they persist in cut-over areas the cause appears to be unseasonable frosts. Detailed study showed that such frost pockets have the highest daily temperatures, the lowest night temperatures, and the shortest growing season, with a prevalence of heavy frosts in late spring that kill back shoot growth (p. 28).

42.21 (74) : 12.25–8. FELT, E. P. **Delayed winter injury.** *Proc. 19th nat. Shade Tree Conf.* 1943 (19–22). [385].

Very low temperatures during the winter of 1933–34 resulted in severe injury to trees in New England, including Sugar Maples and several species of Oaks, and many unthrifty trees died over a considerable period following this extreme winter.

Winter drying, associated with abnormally high temperatures in March and early April before the ground had thawed, caused dieback in Rhododendrons and other shrubs in 1941.

The winter of 1942–43 was severe in southern New England and as a result many exotic trees and shrubs were killed. The result of snow protection was very marked, particularly in species of *Picea*, *Abies* and *Taxus*; shoots above the snow-line showed rosetting while those below the snow-line made normal growth.

42.21 (78.3) : 12.26–8 : 23.21. GEORGE, E. J. **Chinese Elm injury in 1942.** *Bi-m. Bull. N. Dakota agric. Exp. Sta.* 6, 1944 (27–32). [386].

There is fairly conclusive evidence to show that severe injury to Chinese Elm (*Ulmus pumila*) and other woody plants in North and South Dakota, and to a less extent in Montana and Wyoming, towards the end of September 1942, was caused by a combination of plentiful soil moisture and a sudden drop in temperature accompanied by snowfall. In many cases recovery of the trees was rapid during the summer of 1943, when precipitation was favourable to growth.

Chinese Elm is a late maturing species and it is recommended that in future it should not form more than 15–20 per cent. of the composition of any plantation. In order to hasten autumn maturity it is suggested that: (1) Irrigation of this species should not be practised between the middle of August and the time of the first freeze sufficient to check growth. (2) Except in dry autumns, weeds should be allowed to grow among the trees in order to reduce soil moisture. (3) Future plantings should be confined to the drier sites, and not established in depressions receiving run-off or on sites having a high water table.

42.22 : 23.24.1. UNITED STATES. **Annual report, 1944: Northeastern Forest Experiment Station.** Northeastern Forest Experiment Station, Philadelphia, Pennsylvania. [1945]. pp. 52. [387].

Results from tests made with planting stock in a laboratory drought machine have shown that under severely dry conditions the coating of plants with lanolin or commercial wax reduces water loss by more than half, and more than doubles the period of plant survival. Field tests indicate that protective coatings may increase survival by 15–20 per cent. under moderate drought conditions at negligible cost. The coatings are applied in emulsion form to tops by spraying or dipping (p. 32).

42.3. *Precipitations*

42.32 : 12.25. DOWNS, A. A. **Minimizing glaze damage in Pine.** *Tech. Note Appal. For. Exp. Sta.* No. 55, 1943. pp. 5. [388].

Severe glaze storms, such as that of January, 1943, in Virginia and North Carolina, damage forest trees and sometimes cause heavy losses. Damage to Southern Yellow Pine (*Pinus ponderosa*) consists of bending, uprooting, and top and bole breakage; branch breakage in this species is light or negligible, though in hardwoods it is always serious.

Pine reproduction up to about 12 ft. usually weathers a glaze storm without much damage. In stands 2–6 in. d.b.h. severe bending is the principal type of damage, especially in dense stands where the trees are slender: trees of this size that have not been crowded and are well developed with vigorous crowns are better able to withstand glaze storms. The principal damage to trees 6–10 in. d.b.h. is bole and top breakage, with uprooting at times. Thinning in dense stands of this size is undesirable, because the weak trees, deprived of support, are severely damaged. Trees 10 in. d.b.h. and larger are usually sturdy dominants and co-dominants and damage is light and more or less

restricted to the weaker trees of smaller diameter. The best way of preventing glaze damage is by thinning at the right time to obtain a well-spaced stand of vigorous fast-growing trees.

42.32 : 11.14 (54.2) : 23.21. GRIFFITH, A. L. **Snowfall in Dehra Dun.** *Indian For.* 71, 1945 (117–8 + plates). [Forest Research Institute, Dehra Dun.] [389].

Many of the exotic tree species under cultivation at Dehra Dun suffered severely from breakage as a result of a most unusual snowfall and frost on the night of January 10th, 1945. Main stems were broken in a very large percentage of Teak (*Tectona grandis*), *Casuarina equisetifolia*, *Albizzia procera*, *Dalbergia latifolia*, *Acacia catechu* and *Cassia* spp., while *Cassia fistula*, *Anthocephalus cadambra*, and *Terminalia myriocarpa* suffered severe damage by breaking of the branches. Among the species which survived the snow, but suffered after-effects from the thaw, were *Chikrassia tabularis*, *Acrocarpus fraxinifolius*, *Markhamia platycalyx*, *Schleichera trijuga*, *Eugenia jambolana* and young coppice of Sal (*Shorea robusta*). The most unexpected escape from any damage was that of *Sterculia alata*, a species whose branches frequently break in normal years owing to the weight of its foliage. Local species such as Chir (*Pinus longifolia*), Sal (*Shorea robusta*) and Shisham (*Dalbergia sissoo*) also escaped damage.

The relative amount of damage suffered by the various species is shown in tabular form.

42.5. *Chemical Influences. Nutrient Deficiencies*

42.5 : 23.27. STRONG, F. C. **A study of calcium chloride injury to roadside trees.** *Quart. Bull. Mich. agric. Exp. Sta.* 27, 1944 (209-24). [390].

An analysis of case histories of roadside trees showing slight or severe injury thought to be due to calcium chloride has shown that, while the majority of the cases exhibit clear evidence of this type of injury, other factors are also involved, including (1) drought conditions, (2) the opening up of stands, (3) excessive drainage, and (4) mechanical injuries. Injury from calcium chloride used in the treating of roads occurs mainly where trees are located either on a lower ground level than the surface of the highway, so that run-off waters are impounded, or on the highway shoulder close to the travelled surface where a considerable amount of loose material is thrown by traffic on to the soil at the base of the trees.

Under experimental conditions calcium chloride contained in dust may, when applied to foliage, produce a brown spotting of the leaf, but such injury (which is distinct from leaf scorch) has not been observed on leaves examined along calcium chloride treated highways, probably on account of the lower concentration of the salt. The relative tolerance of various tree species to calcium chloride in the soil is indicated. *Quercus borealis*, *Q. alba* and *Ulmus americana* are fairly resistant, while *Fagus grandifolia*, *Acer saccharum*, *Populus deltoides* and *P. tremuloides* are among the more susceptible species.

The addition of sodium chloride to soil affects tree growth in two ways: (1) by retarding the intake of water, and (2) by causing an accumulation of the salt within the plant tissues. A study of the comparative toxicity of sodium chloride and calcium chloride revealed that the former is at least 5 to 10 times more toxic to Elm (*Ulmus americana*) and White Pine (*Pinus strobus*) seedlings than the latter.

Remedial measures are suggested.

42.5 : 12.25 : 21.32. HOBBS, C. H. **Studies on mineral deficiency in Pine.** *Plant Physiol.* 19, 1944 (590–602). O.B.D. [Purdue Univ., Lafayette, Indiana.] [391].

An account of greenhouse experiments with four species of Pine seedlings (Pitch, Red, White, and Shortleaf Pines) grown under conditions of deficient nitrogen, phosphorus, potassium, and magnesium respectively. The symptoms caused by the various types of mineral deficiency are described. Nitrogen, phosphorus, and potassium deficiencies were accompanied by greatly reduced growth; the effect of magnesium deficiency was less marked.

42.5. WALLACE, T. **The diagnosis of mineral deficiencies in plants: a colour atlas and guide: supplement 1944.** H.M. Stationery Office, London. 1944. pp. 9 + 48 (plates). Price 5*s.* 0*d.* [392].

42.5 : 12.25. HEPTING, G. H. **Reserve food storage in Shortleaf Pine in relation to little-leaf disease.** *Phytopathology* 35, 1945 (106–19). [U.S.D.A. Division of Forest Pathology.] [393].

Quantitative analyses of food reserves in Shortleaf Pine (*Pinus echinata*) showed that the root bark of little-leaf trees had an average of less than half as much food as that of healthy trees, and that at times reserve food was almost entirely absent from some roots of diseased trees. The stems of little-leaf trees had as much food as normal trees at all times.

The average needle of little-leaf trees cut in April contained only 41 per cent. as much elaborated food as the average needle of adjacent healthy trees. The total foliated parts of these trees were computed to have a reserve food content less than 10 per cent. of normal. Examination of two roots from each of the trees used in the foliage analyses showed the diseased roots to have a reserve food content of only 33 per cent. of normal.

The symptoms of decline in little-leaf trees appear to be due to a low synthesis of carbohydrates. The roots suffer most from inadequate nutrition. *From author's summary.*

42.51. MÜHLSTEPH, W. Wege zum chemischen Nachweis von Abgas- (Rauch-) Schäden mit besonderer Rücksicht auf den Wald. **[Methods of proving chemically the injury caused by waste gas (smoke), with particular reference to the forest.]** *Thar. forstl. Jb.* 93, 1942 (631–58). [G.g.] [Institut für Pflanzenchemie und Holzforschung in Tharandt.] [394].

The author discusses the place of chemical investigations in determining the relationship between plant injury and the presence in the air of poisonous waste gases. Although it has been possible to detect poison gases and other impurities in the atmosphere, the data obtained have been of limited value in respect of their application to the problem of plant injury. The main difficulty in proving gas damage chemically lies in the choice of the time and place of investigation, since the occurrence of waste gases in the atmosphere depends to a large extent on external factors difficult to assess, such as the strength and direction of the wind, precipitation, mist, topography, and ground cover. In addition to these variations in local conditions, various plants react differently to poisonous materials. The author discusses some of the problems involved in detecting and assessing the importance of gaseous and solid impurities in the atmosphere, in atmospheric precipitation (including rain and snow), in the soil, and on the plant itself.

By means of analyses of the atmosphere it has been possible to determine the actual or relative percentage of impurities present, but no data have been obtained on the minimum concentration of an impurity which is required to cause actual damage to plant life. The poison content of the air is no criterion of the danger to plants, since injury frequently occurs only after the poisonous material has been deposited on the leaves. Precipitation analyses are of value mainly because they give an indication of the general condition of the air with regard to gaseous and solid impurities. Soil analyses have generally proved useless, since many of the poisonous substances found in smoke are already present in varying amounts in most soils. Analyses of plant materials are also of questionable value. Although some gases, such as fluorine, can be detected easily within a wide radius of the factory producing them, they do not necessarily result in damage to plants. It has been found impossible to determine a *dosis letalis* for plants, since sensitivity to air impurities varies widely under different conditions. The data obtained must be regarded as an indication rather than as a proof of the relationship between gases and plant injury.

42.6. *Electrical and Cosmic Influences*

42.61 (73). THOMPSON, A. R. **Lightning struck tree survey.** *Proc. 19th nat. Shade Tree Conf.* 1943 (34–41). [395].

This report covers the seven-year period during which the National Shade Tree Conference has been conducting a lightning struck tree survey. Results are tabulated and analysed. The genera of greatest apparent susceptibility are Oak, Elm, Poplar, Tuliptree, Ash, Pine, Maple. The data indicate that a lightning-struck Oak has perhaps a 6 to 5 chance of recovery, while an Elm has a 6 to 1 chance. Twenty-four per cent. of the trees struck were standing alone, 67 per cent. in a group, and 9 per cent. in forest.

43. FOREST FIRES

43 (47.2–6). SEREBRENNIKOV, P. P., and MATRENINSKI, V. V. Okhrana lesov ot pozharov. **[Forest fire protection.]** Goslestekhizdat, Leningrad. 1940. pp. 118 + map + tbls. [Russ.] [396].

Large areas of forest in the U.S.S.R. are

destroyed annually by fire, the average figure being 500–700 thousand ha.; in some years (1921, 1932, 1936) the area of forest so damaged was as much as 2 million ha. In this bulletin the authors give data to indicate the damage caused to the forests by fire, and discuss in detail forest fire protection under the following chapter headings: The importance of forests in the U.S.S.R. and the task of fire protection; the forest wealth of U.S.S.R.; types of forest fire; inflammability of forests; causes of forest fire; damage and economic loss caused to forests by fire; organization of forest fire protection; advance measures; detection of fires; and suppression of fires.

43 (47.2–6). MELEKHOV, I. S. O teoreticheskikh osnovakh lesnoy pirologii. **[On the theoretical bases for studying forest fires.]** Arkhangel'ski Lesotekhnicheski Institut. 1944. pp. 19. [Russ.] [397].

This bulletin summarizes the contents of an unpublished two-volume book based on a wide range of research and investigation in the northern forest zones of the U.S.S.R., and on a review of Russian and other literature. The following investigations were made in the field: (1) In 1937 in the three northern provinces of Krasnoborsk, Plesetsk and Tomesk on (*a*) the nature of forest fires, (*b*) methods of fire-fighting, and (*c*) the natural occurrence of forest fires. (2) In 1939 mainly in coniferous forests in the river basin of the North Dvina on (*a*) damage to trees by fire, (*b*) type and degree of wood destruction by fire, and (*c*) anatomical changes in the wood of Pine (*Pinus sylvestris*) caused by fire. (3) In 1940 mainly in the coniferous forests of the river Vȳchegda on (*a*) periodicity of forest fires, (*b*) fire wounds on trees, (*c*) further classification of fire damage caused to trees, (*d*) anatomical changes in the wood of Pine. (4) In 1941, in the area of the lower Vychegda, on (*a*) sap flow in Pines in relation to fire damage, (*b*) the seasonal activity of Pine cambium in relation to forest fires.

It is pointed out that the number of forest fires occurring in the U.S.S.R. is far less than that in Canada and the United States, but is nevertheless considerable. Extensive areas of forest are burned annually, varying from some hundreds of thousands of hectares on the average, to several million hectares in extreme years. Thus for the five years 1931 to 1935 an average area of 1 million ha. was burned over annually, varying from 230 thousand ha. in 1935 to 2·1 million ha. in 1932.

In an investigation of one area of 19,000 ha. there were found traces of 30 separate fires that had occurred in the last 90 years, the forest area covered by fire amounting to 60 per cent. of the whole region, some parts of it being burned over several times. The seriousness of the problem as it affects future timber supplies, soil deterioration, stream flow, wildlife, etc., is emphasized.

43 (494). WINKLER, O. Erfahrungen und Lehren aus der Waldbrandkatastrophe am Calanda bei Chur, August/September 1943. **[Experience and knowledge gained from the catastrophic forest fire at Calanda near Chur, August/September 1943.]** *Schweiz. Z. Forstw.* 95, 1944 (386–404 + plate). [G.] [398].

The forest fire at Calanda, which lasted from August 20th to September 13th, 1943, was one of the greatest fire catastrophes in Switzerland within recent years. The large area affected, its topography, and the scarcity of water were among the particular difficulties encountered by the fire fighters and necessitated reinforcements of troops to bring the fire under control. The characteristics of the fire and the problems involved in its control are discussed in detail, and various means for preventing the spread of fire in mountainous country are described.

43.1. *Protective Measures*

43.1 : 07.7 : 61.32 : 23.23 : 45.3. **Aircraft and the forest.** *Wood* 10, 1945 (98–100). [U.S. Forest Service.] [399].

The United States Forest Service has conducted experiments along many lines in the use of aircraft for forestry. Aircraft have been found to be especially valuable in fire detection on newly acquired National Forest areas where the stationary lookout-system has not yet been fully developed. Experiments have also been made in the use of photographs taken by observation planes as an aid in the scouting of forest fires. In Montana, recently, forest officers photographed a fire, developed and printed an 8 × 10 picture, and dropped it to the ground within 18 minutes. The photo was judged to be better than any map that could have been sketched by the most expert scout. The exposed films are sometimes dropped to a base

camp when facilities for developing during flight are not available.

Bombing experiments have been made with the object of retarding small back-country fires until the arrival of ground forces. This has to be done at low altitude and presents many difficulties, especially in mountainous country. It has been found that the extreme scattering of water or chemicals when released from the air makes this method ineffective and impracticable for extinguishing fires. Chemical research has been conducted to determine the most effective combination of chemicals to retard fire spread; the most effective compound tried so far is one containing a 10 per cent. solution of monammonium phosphate.

Limited use of parachute fire crews has already resulted in material savings, and the method is particularly promising for the early suppression of otherwise inaccessible fires.

Aerial photography has been widely used by the Forest Service and large areas of the National Forests have been mapped from aerial photographs.

Tests have been made on direct seeding of forest trees from aeroplanes, but the cost of collecting the enormous quantities of seed necessary is prohibitive.

Preliminary tests in the use of aircraft for detection of outbreaks of forest-insect pests have been very encouraging. Areas of infestation can often be readily detected and mapped from the air. Attempts to control forest insects from the air have been only moderately successful, owing to the extreme hazard involved in flying sufficiently low. Recent tests with the autogiro have demonstrated its great superiority for such work. It has also been suggested that the autogiro might be of use in timber-lifting operations.

43.11 (6) : 97.1 : 92. DUNDAS, J. **Bush burning in Tropical Africa.** *Emp. For. J.* 23, 1944 (122–5). [Forest Department, Nigeria.] [400].

The regional control of bush burning in British Tropical Africa is deemed to be ineffective, except in Nyasaland, because it is based on preventive legislation, and there has been no staff to enforce it. It is considered that control should be placed in the hands of Forest Departments, who alone have the experience and the staff, and that, except in the *Glossina morsitans* belt of East Africa, it should take the form of organized early burning sanctioned by positive legislation.

43.13 : 07.7. GODWIN, D. P. **The development of fire-fighting equipment since Pearl Harbor.** *J. For.* 43, 1945 (104–8). [U.S. Forest Service, Washington, D.C.] [401].

An account is given of progress made by the U.S. Forest Service in developing equipment such as ploughs, tankers and flamethrowers, methods of radio control and the parachuting of men and material. Certain kinds of military equipment hold promise for the future in this connexion, including jeeps and other automotive equipment, and a start has already been made in planning their adaptation to fire-control needs. Careful review of all types of military aircraft shows that there are only 5 or 6 types really suitable for forestry work. The L-5 Vultee seems ideal for scouting and reconnaissance. The Forest Service has so far been unable to secure a test model of a helicopter. Other equipment, developed by industry and tested by the Forest Service, includes small petrol engines, optical and photographic devices, pick-up devices, chain-saws, fog pumps and nozzles.

43.13. DURRELL, G. R. **Training in fire-fighting tactics.** *J. For.* 43, 1945 (118–20). [Division of Forestry and State Parks, Oklahoma Planning and Resources Board, Oklahoma City, Okla.] [402].

The article describes an indoor method of training fire-fighters in fire-suppression tactics, which has given good results in Oklahoma. It consists essentially in plotting alternately the increment of the perimeter of a fire and of the control line by 15-minute intervals. Two sets of scales have been prepared for each fire-danger class, one showing rate of spread of head, flank and rear of a fire for different slopes, the second the amount of control line that can be constructed by crews of various sizes and with various types of equipment, both by 15-minute periods. The author will be glad to send samples of his cards and other devices to any one interested, so far as the available supply permits.

44. DAMAGE BY HARMFUL PLANTS. VIRUS DISEASES

44.1. *Forest Weeds*

44.1. JONES, F. D. **New chemical weed killers.** *Amer. Nurserym.* 81 (5), 1945 (9–10). [403].

DCP (2.4 dichlorophenoxyacetic acid) and TCP (2.4.5 trichlorophenoxyacetic acid) are two of the most effective chemical weed-killers at present available in the United States. Weeds vary greatly in the speed of their reaction to these chemicals. In general, plants in a heavy soil take twice as long to die as those in a light soil. The nature of the carrier has a great influence on the effectiveness of the spray. The formula with the highest effectiveness is 'Weedone', a liquid which mixes readily with water in any proportion to form an emulsion for spraying. Among the weed trees which can easily be killed with DCP are Sassafras, Black Locust, Honey Locust, and Chokeberry. Spraying is usually most effective at temperatures of 70° or over. Since the new chemicals do not kill most grasses they promise to be of value as selective weed-killers for use in lawns.

44.3. *Fungi*

44.3 : 12.25 (410) : 42.21. GREAT BRITAIN. **Twentieth annual report, the Imperial Forestry Institute, 1943–44.** University of Oxford. 1944. pp. 12. [404].

A widespread and locally serious die-back of Corsican Pine, apparently caused by frost injury, is reported from different parts of England and Wales; severe needle cast of this species associated with *Hypodermella sulcigena* has also been recorded. Investigations have shown that in both cases disease was most serious in topographical positions where the occurrence of stagnant air and relatively good early growth was favoured (p. 7).

44.3 : 12.25 : 12.21 : 23.21. WOJTYLKO, E. Das Fichtensterben durch Hallimasch im Bereich der Forstverwaltung Rzyki der Herrschaft Saybusch O.-S. nach dem Stand vom Frühjahr 1942. **[Die-back of Fir through *Agaricus melleus* Vahl in the forest management district of Rzyki in Saybusch O.-S. according to the position in the spring of 1942.]** *Thar. forstl. Jb.* 93, 1942 (659–76). [G.] [405].

After a short description of local conditions the author discusses the spread of infection by *Agaricus melleus* in the Rzyki district as evidenced by the increasing number of dead standing or fallen trees, especially in the pure Spruce stands. In mixed stands of Spruce, Fir and Beech, the Spruce is practically undamaged. Infection does not generally occur in trees less than 40 years old, but on eastern slopes the first symptoms may appear in trees only 30 years old. From this age onwards mortality increases until the climax is reached in 50- to 70-year-old stands. At this age the stands are so opened up that they usually fall an easy prey to spring storms. Comparatively little damage has been observed in stands on west or northwest slopes, whereas stands on eastern slopes have suffered severely. In 94 per cent. of the cases examined the mycelium of the fungus was found to have started development in roots stretching in an easterly direction.

The author strongly recommends the planting of mixed stands of Fir, Beech, Spruce and Larch.

44.3 : 12.25 : 12.14.3 : 12.21. JACKSON, L. W. R. **Root defects and fungi associated with the little-leaf disease of Southern Pines.** *Phytopathology* 35, 1945 (91–105). [U.S.D.A. Division of Forest Pathology.] [406].

A study of the symptoms and possible causes of the little-leaf disease of Shortleaf and other Pines. The root systems of infected trees of *Pinus echinata* were found to be consistently more defective than those of healthy trees, although no observable differences were noted in the gross morphology of the root. Sclerotia of a soil-inhabiting fungus, *Poria cocos*, were frequently found on the roots of little-leaf trees, and a species of *Torula* (*T. marginata*) was regularly associated with newly-formed brown patches (the result of excessive exfoliation of bark) on the roots of diseased Pines. Both species of fungi produced brown patches and wood infections when inoculated on roots of adult Shortleaf Pines, and a large percentage of 2- and 3-year-old plants of this species grown in pots in non-sterile soil dried as a result of inoculation. A higher percentage of dead plants occurred in the *Poria* series.

Under natural conditions typical little leaf has seldom been found on trees younger than 20 years or less than 3 in. d.b.h. No pathogenic fungus which might be responsible for the disease has been found on the above-ground parts of the tree.

44.3 (69) : 12.25 : 12.21. MAURITIUS. **Annual report of the Forest Department 1943.** Govt. Printer, Port Louis, Mauritius. 1944. pp. 11. [407].

While *Armillaria mellea* has made considerable progress in one area of *Pinus caribaea*, it can be kept in check by heavy thinning and the cutting of undergrowth. It is believed that grass induces soil conditions favourable to the fungus (p. 5).

44.3 : 12.25 (494) : 12.21. TERRIER, C. A. Über zwei in der Schweiz bisher wenig bekannte Schüttepilze der Kiefern: *Hypodermella sulcigena* (Rostr.) v. Tub. und *Hypodermella conjuncta* Darker. [**On two hitherto little-known needle-cast fungi of Pines in Switzerland: *H. sulcigena* and *H. conjuncta*.**] *Phytopath. Z.* 14 (5), 1943 (442–9). [G.] E.S.R. 91 (173). [408].

The pathogens are described, and the symptoms, damage caused, susceptibility, geographical distribution, and control are discussed.

44.3 : 12.25 : 12.21. PLAKIDAS, A. G. **Blight of oriental Arborvitae.** *Phytopathology* 35, 1945 (181–90). [Louisiana Agricultural Exp. Sta., Baton Rouge.] [409].

A destructive disease of oriental Arborvitae (*Thuja orientalis*), known locally as 'blight' or 'fire', is characterized by necrosis and shedding of foliage and branchlets, and by the formation of bark cankers on small twigs.

The cause of the disease, demonstrated by pure culture inoculations, is a *Cercospora*, apparently an undescribed species. This is described under the name of *C. thujina*, n. sp.

Perithecia of *Mycosphaerella* sp. were often found on diseased Arborvitae leaves and branchlets, either alone or in association with the *Cercospora*, and it was thought at first that this might be the ascigerous stage of the latter. Repeated inoculations with several ascospore isolates of the *Mycosphaerella*, however, failed to cause infection, and it must be assumed that this fungus bears no relation either to the *Cercospora* or to the disease.

A limited spraying test using 4-4-50 Bordeaux, cuprous oxide (Cuprocide, 89 per cent. Cu) at the rate of 3 lb. in 100 gals. of water, and basic copper sulphate (Tennessee Copper Co. 'Tri-basic', 53 per cent. Cu) at the rate of 6 lb. in 100 gals. of water, completely checked the progress of the disease on diseased plants. These results indicate that the disease is amenable to control by copper. *Author's summary.*

44.3 (41.5) : 12.25–8 : 12.21. EIRE. **Report of the Minister for Lands on forestry for the period from 1st April, 1938, to 31st March, 1943.** Stationery Office, Dublin. [1944?]. pp. 65. [410].

The most serious fungous damage in plantations during the period under survey was caused by *Armillaria mellea*, especially to Sitka Spruce, on areas recently cleared of scrub or old timber. Other fungi recorded include *Adelopus* on Douglas Fir, *Lophodermium* on Pines under severe exposure, and a rather serious attack of *Nectria* on Ash (p. 34).

44.3 : 12.26–8 : 12.25 : 12.21. CRANDALL, B. S., GRAVATT, G. F., and RYAN, M. M. **Root disease of *Castanea* species and some coniferous and broadleaf nursery stocks, caused by *Phytophthora cinnamomi*.** *Phytopathology* 35, 1945 (162–80). [U.S.D.A. Bureau of Plant Industry, Beltsville, Mo.] [411].

The fungus, *Phytophthora cinnamomi* Rands, is responsible for a destructive root rot of Chestnut and Chinkapin trees (*Castanea* spp.) in the United States. The author gives an outline of the work leading to the identification of the fungus, and reports on inoculation and field tests that have proved its pathogenicity on Chestnut and other hosts. The fungus causes a similar root disease in forest-tree nursery stock. Infection has been observed in the nursery on twenty broadleaf and coniferous species. Field and greenhouse inoculation tests have demonstrated the susceptibility to the disease of European Chestnut (*Castanea sativa*). The Asiatic species, *C. crenata*, *C. mollissima*, *C. henryi*, and *C. seguinii*, however, show a high degree of resistance. It seems probable that root rot of this type has been responsible for the recession of the American Chestnut in some areas of the United States. No satisfactory control measures have been evolved. Hybrid varieties resistant to both blight and root rot are being developed by crossing American Chestnut and Chinkapins with Asiatic species.

44.3 : 12.26–8 : 12.21. CRANDALL, B. S., DAVIS, W. C. ***Phytophthora* wilt and stem canker of *Cinchona*.** *Phytopathology* 35, 1945 (138–40). [U.S. Division of Latin American Agriculture.] [412].

Notes on diseases of *Cinchona* seedlings and older stock caused by fungi of the genus *Phytophthora*. Control measures are indicated.

44.3 : 12.26–8 : 12.21. DARLEY, E. F., and CHRISTENSEN, C. H. **The culture designated Madison 517 identified as *Polyporus tulipiferus*.** *Phytopathology* 35, 1945 (220–2). [University Farm, St. Paul, Minnesota.] [413].

The writers present conclusive evidence that the fungus 'Madison 517' (earlier described as *Fomes annosus* (Fries) Cooke) is *Polyporus tulipiferus*. The species has been used extensively in the United States for more than 20 years as one of the standard laboratory test organisms to determine the relative toxicity of wood preservatives.

44.3 (74) : 12.26–8 : 12.21. **Report of Northeastern Committee on Dutch Elm disease.** Massachusetts Forest and Park Association, 3 Joy Street, Boston, Mass. 1942. [pp. 4]. [414].

The Committee reports on the present state of the Dutch Elm disease (*Ceratostomella ulmi*) in the northeastern United States and recommends that for the war period control work should be continued to the extent that progress already made shall be maintained. To this end the following activities are considered as the minimum requirements: (1) Continuation of the research programme. (2) Continuation of scouting, the removal of infected trees and sanitation work within the protective zone now established. (3) The development of a systematic programme of education to bring about public co-operation in schemes for disease control.

44.3 : 12.26–8 : 12.21 : 23.22.2. BAGCHEE, K. D **Pathological notes No. 2. Wilt and dieback of Shisham, Babul and Khair in the artificial regeneration under agriculture-cum-forestry management.** *Indian For.* 71, 1945 (20–4 + plate). [Forest Research Institute, Dehra Dun.] [415].

Wilt and dieback of Shisham (*Dalbergia sissoo*), Babul (*Acacia arabica*) and Khair (*A. catechu*) are discussed with reference to environmental factors and causal organisms. The author urges the creation of extensive plantations by the *taungya* method to provide timber and fuelwood for local consumption, but suggests that cultivation should not be carried out until the trees are established; frequent cultivation increases the danger of root injury which often leads to infection by fungi.

44.3 : 12.26–8 : 12.21. GRUENHAGEN, R. H. ***Hypoxylon pruinatum* and its pathogenesis on Poplar.** *Phytopathology* 35, 1945 (72–89). [416].

The prevalence in Wisconsin of a Poplar canker caused by *Hypoxylon pruinatum* (Kl.) Cke. was studied during the summers of 1941, 1942 and 1943. The disease occurred most commonly on the poorest site surveyed and was least common on the best site. A high percentage of cankers were observed on trees of less than 8 in. d.b.h. Although occurring mainly on *Populus tremuloides* and *P. grandidentata*, the fungus was also found on *P. balsamifera*. The symptoms of the disease are briefly described and the growth and habits of the causal organism are reviewed in relation to its pathogenicity. Infection occurs most easily through bruised and killed tissue.

45. DAMAGE BY ANIMALS

45.1. *Mammals*

45.11 (71.4) : 97.3. MORAIS, L. Méfaits du pâturage en forêt. **[Damage caused by pasturing in forest.]** *For. québec.* 9, 1945 (69–84). [F.] [417].

Though there are few statistics on the use of woods for pasture in Quebec, this has been a general practice, and an enquiry conducted in 1940 by the Ministry of Agriculture showed that 80 per cent. of the Maple woods were used for this purpose. It is probable that an equal proportion of the stands destined for timber production are also used for grazing. This practice has bad effects on the soil, and damages seedlings and the roots of trees. Moreover, forest pasture is of relatively poor quality, and when forage and timber are grown together the land is not used efficiently for either crop.

45.12 : 12.14.3 : 12.25. MOORE, A. M. **Damage by wild pigs.** *N.Z. J. For.* 5, 1942–44 (57). [418].

In Kaingaroa State Forest it was recently found that the surface roots of *Pinus laricio* had been uncovered by wild pig and the bark chewed off to the trunk of the tree; in some cases all surface roots within a radius of 6 ft. of the trunk had been stripped of bark. Roots of *P. radiata*, *P. murrayana* and *P. ponderosa* were uncovered, but not chewed. In 16-year-old *P. canariensis* bark had been chewed from the laterals and also from the main tap root, damage extending in many cases 9 in. below the soil surface. Under favourable soil conditions, *P. canariensis* has put forth dense mats

of adventitious rootlets above the damaged tap root. It is possible that Pine bark may be a starvation diet adopted as a result of the closing of the canopy, the suppression of bracken fern and the formation of a forest floor interlaced with a network of roots unfavourable to pig rooting.

45.12 : 12.25 : 13.2. MAURITIUS. **Annual report of the Forest Department 1943.** Govt. Printer, Port Louis, Mauritius. 1944. pp. 11. [419].

The failure of 1915-22 plantations of Pine in Nouvelle Découverte is due chiefly to damage by monkeys. *Pinus taeda* is particularly susceptible to damage, the upper crown being ring-barked and the top sometimes blown off in consequence. While the wounds on Chinese Pine (*P. sinensis* var. *tabulaeformis*) are more easily healed over, deep longitudinal scars are common. Disturbance appears to be the most effective check on these animals as plantations near houses and frequented paths are undamaged (p. 5).

45.3. *Insects*

45.3 (494). SCHNEIDER-ORELLI, O. Über den heutigen Stand der Schädlingsbekämpfung in der Land- und Forstwirtschaft. [**On the present position of pest control in agriculture and forestry.**] *Schweiz. Z. Forstw.* 95, 1944 (361–73). [420].

Three factors which have promoted the development of practical control methods against insect pests in Switzerland are: (1) the general increase in the intensity of agricultural land use; (2) the introduction of foreign species of harmful insects (e.g. *Eriosoma lanigerum, Phylloxera vastatrix, Dreyfusia nüsslini, Leptinotarsa decemlineata* and *Aspidiotus perniciosus*); and (3) advances brought about by scientific research, including investigations by professional and amateur entomologists on systematic and biological questions and work on means of control carried out by the Swiss chemical industry.

The chief external abiotic and biotic factors which influence the development and spread of insect pests are briefly discussed. Of the former, temperature and humidity are the most important. With regard to biotic factors, plantations composed of a single tree species are more likely to suffer severe damage than are mixed plantations in which the insect/predator relationship is more evenly balanced. Accurate identification of insect species is sometimes difficult owing to the occurrence of both winged and wingless generations of the same species or the use by alternate generations of different host plants.

The author distinguishes between indirect or preventive measures and measures of direct control. He recommends certain cultural and other practices which should lessen the risk of insect damage both in agriculture and in forestry. Direct methods of control are considered under three headings: mechanical control; chemical control; and biological control. Chemical control includes the use of stomach poisons, contact poisons (general cell poisons, nerve poisons, and substances which cause suffocation by forming an oily layer over the insect's body and hermetically shutting out the outer air) and inhaled poisons. Examples are given of each type of poison.

45.3 (71) : 05.3. CANADA. **Annual report of the Forest Insect Survey, Forest Insect Investigations, Division of Entomology, Science Service, 1943.** King's Printer, Ottawa. 1944. pp. 68. [421].

For the first time this report is presented on a regional basis with the result that considerably more detail is given than in previous years. Individual summary reports are given for (1) Maritime Provinces and Newfoundland (1,431 collections), (2) Quebec (5,285), (3) Ontario (in part) (2,030), (4) Prairie Provinces and far western Ontario (390), (5) British Columbia and Western Alberta (657). The main portion of each report is concerned with the status during 1943 of individual forest and shade tree insect pests classified according to relative importance and the seriousness of the damage they are causing. In all but the first report the Spruce budworm (*Cacoecia fumiferana*) heads the list of important species causing serious injury at the present time.

45.3 : 44.1 : 12.11.15. WHITE, G. C. **New plant protection products.** *Amer. Nurserym.* 81 (6), 1945 (11, 31–3, 36–7). [422].

A general discussion on the use and efficacy of DDT (dichloro diphenyl trichloroethene), DD (a mixture of dichloropropylene and dichloropropane), Dithane, Dowfume and Aerosols as insecticides. DDT is both a contact and a stomach poison. Although it is not effective against certain insects such as red mite and red spider, its range of usefulness is very

wide. Lindens sprayed with this insecticide suffered practically no foliage injury through Japanese beetles, whereas neighbouring untreated trees were practically defoliated. Some of the preparations (e.g. DD, which is used against soil nematodes) are toxic to plants, and no planting should be done in treated soils for a minimum of ten days after treatment. Reference is made to the use of plant hormones for promoting the growth of cuttings and preventing pre-mature fruit fall, and to the employment of 2, 4-dichlorophenoxyacetic acid as a selective weed-killer.

45.3 : 12.25 : 13.2. Ass, M. J., and FUNTIKOW, G. P. Die Besiedlung künstlich geschwächter Bäume durch schädliche Insekten. **[The infestation of artificially weakened trees by harmful insects.]** *Z. angew. Ent.* 28, 1941 (157–79). [G.] *Abstr.* in *Z. PflKrankh.* 53, 1943 (310). [G.] R.A.E. 33A (14). [423].

This is an account of observations in Germany on the insect population that developed in a Spruce and a Pine tree that were injured by fire in 1928 and in another Spruce tree that had its crown sawn off in the same year. Pests, chiefly bark-beetles, attacked the trees in large numbers, so that the scorched trees were completely dried out by 1930. *Ips typographus*, L., attacked both the Spruces equally, but *I. chalcographus*, L., preferred the one that had been sawn off.

45.3 (43.1–5) : 12.25 : 13.2 : 13.14. SCHWERDTFEGER, F. Zur Biologie des Forstschädlings *Acantholyda erythrocephala* L. **[On the biology of the forest pest *A. erythrocephala*.]** *Photogr. u. Forsch.* 3, 1941 (161–9). [G.] *Abstr.* in *Z. PflKrankh.* 53, 1943 (310–1). [G.] R.A.E. 33A (14). [424].

Areas in Germany that were reforested with Pine after the outbreak of *Panolis flammea*, Schiff., in 1922–24, appear to be offering favourable conditions for certain sawflies, including *Diprion pini*, L., which do not usually reach outbreak numbers. *Acantholyda erythrocephala*, L., has recently caused considerable damage to stands 9–12 years old. In March, 1940, old needles were lacking and even some of the young ones had been attacked. The May shoots showed injury to the bark and needles and were backward in growth. The larvae overwinter, some of them more than once. Pupation occurs in spring, and the pupal stage lasts 1–3 weeks. The eggs are laid in the needles, and the larvae feed in groups of up to 35 in webs. They first attack the old shoots, and then, for lack of food, the May shoots. They can be controlled by dusting with an arsenical from an aeroplane.

45.3 (47.1) : 12.25 : 13.2. LOVÁSZY, P. Ueber das schädliche Auftreten von *Laspeyresia illutana* H.S. (Lep. Tortricidae). **[The occurrence as a pest of *Cydia illutana*.]** *Ann. ent. fenn.* 8, 1942 (214–7). [G.] *Abstr.* in *Z. PflKrankh.* 53, 1943 (309). [G.] R.A.E. 33A (12). [425].

Cydia (*Laspeyresia*) *illutana*, H.-S., is here recorded, for the first time in Finland, as a pest in the cones of Norway Spruce (*Picea abies*). The eggs are laid in fresh cones of Spruce or Larch (*Larix sibirica*) in the second half of July, and the larvae hatch from the end of July. They become full-fed at about the end of August, leave the cones and overwinter in the soil. There is only one generation a year. Infested cones do not open properly and retain some of their seeds. Damage to Spruce cones was fairly heavy in northern Finland in 1940 and 1941, but was of much less economic importance than that caused by *C.* (*L.*) *strobilella*, L., and *Dioryctria abietella*, Schiff.

45.3 : 12.25 : 13.12 : 13.2. BALCH, R. E., and BIRD, F. T. **A disease of the European Spruce sawfly, *Gilpinia hercyniae* (Htg.), and its place in natural control.** *Repr.* from *Sci. Agric.* 25, 1944 (65–80). [Dominion Entomological Laboratory, Fredricton, N.B.] [426].

A disease affecting the larvae of *Gilpinia hercyniae* (Htg.) has been the chief factor in bringing about the decline of the outbreak of this species in Canada in recent years. Although the disease was first noticed in heavily infested areas, and although its spread appears to be favoured by a high density of the host population, it has also been responsible for considerable sawfly mortality in lightly infested stands. The author reviews the various forms of natural control before the appearance of the disease and gives data which indicate the importance of the disease as a control factor. Prior to the appearance of the disease, other factors (including parasites) were causing some mortality, but, with the introduction of the disease, mortality increased to such an extent that other factors became of minor importance, and the potential value of the parasites could not

be accurately determined. It appears likely, however, that the relative importance of the disease as a control factor will be reduced when the sawfly population drops to a certain level.

The external and internal symptoms of the disease are described. Smears of the body fluids of infected larvae contain not only elements of disorganized tissues but also myriads of polyhedral bodies ranging in diameter from 0·5 to 1·8 microns, the average diameter being 1·3 microns. The pathological processes of the disease resemble those of virus or 'wilt' diseases of various Lepidoptera. No bacterium or other micro-organism has been regularly isolated from the blood or tissues of diseased larvae after death, but the pathogen can be removed by filtration.

The extreme contagiousness of the disease and its efficient means of spread are shown by its almost simultaneous appearance over large areas. The relative resistance of the various stages of the sawfly to the disease is indicated. No cases of individual immunity or resistance have been observed in the larval stage. The possibility of storing the pathogen in virulent form, so that it can be re-established if necessary, is being investigated. It can be introduced to new areas by spraying foliage with a water extract of diseased larvae.

45.3 : 12.25 (78.7–8) : 13.2. **Beetle plague.** *Timberman* 46 (5), 1944–45 (36–7, 78). [427].

Engelmann Spruce stands in Colorado and Wyoming have been suffering from an infestation of *Dendroctonus engelmanni* Hopk. About 11 million bd. ft. of industrially valuable timber are threatened in Colorado alone. While normally there are some 75–100 larvae and adults of this insect to the sq. ft. of bark, the brood development in the current cycle average 300–600 pupae and adults in the same space.

The epidemic appears to have started following a storm in Colorado in 1939. Windblown timber presented favourable conditions for the beetles, which later spread to standing timber. They attacked the largest and finest trees in a stand, so that a greater proportion of volume is destroyed than the number of trees would indicate. Early detection is impossible, since the damage to a beetle-attacked tree is not externally evident until after the needles begin to fade and drop, which usually does not occur until a year or more after the initial attack and some time after the tree has been girdled and killed. It is both economically and physically impossible to carry out direct control within the confines of the present infestations, but with the aid of natural barriers it may be possible to prevent its spread to other areas.

45.3 (485) : 12.25 : 13.2. Tallmätarkampanjen har givit gott resultat. **[The Pine looper campaign has given good results.]** *Skogen* 31, 1944 (291). [Sw.] [428].

The air-war against the Pine looper (*Bupalus piniarius*) proved very successful in the summer of 1944. Up to the present three large forest areas have been dusted from the air with Gesarol, the composition of which is known only to the manufacturer. While detailed results are not yet available, it has been shown that the new method is highly effective.

45.3 : 12.25 : 13.2. PRELL, H. Der Lärchenblassenfuss (*Taeniothrips laricivorus* Krat.) und das Lärchenwipfelsterben. **[The Larch thrips *Taeniothrips laricivorus*) and the Larch shoot wilt.]** *Thar. forstl. Jb.* 93, 1942 (587–614). [429].

The author traces the various steps in the discovery of the causal agent of a shoot wilt of Larch commonly found in central Europe, and particularly in the eastern Sudetenland. After a good deal of preliminary investigation the conclusion has been reached that the symptoms are caused, not by fungous or virus disease, but by an insect identified as *Taeniothrips laricivorus*. This thrips causes direct damage to Larch by sucking the sap from the superficial cells of the needles. The symptoms of thrips attack are described in detail. In addition to the browning and bending of the needles and the growing tips, there is a tendency for the needles to drop, and the resin which has exuded from the wounds frequently causes the needles to stick together. The general result is an arrest in height growth and the formation of blunt, almost rounded crowns. Thrifty trees are attacked in preference to those weakened by disease. The wounds made by the insect frequently lead to secondary fungous infection.

A brief outline of the life history of the thrips is given, and methods are suggested for its control. It is not known whether the species is indigenous.

45.3 : 12.25 (43.7) : 13.2. KOMÁREK, J. Forstentomologische und andere Beobachtungen über das Tannensterben in Böhmen, Mähren

und den Karpatenländern. **[Forest entomological and other observations on the die-back of Fir in Bohemia, Moravia and the Carpathian lands.]** *Thar. forstl. Jb.* 93, 1942 (615–30). [G.] [430].

Observations are made on entomological and other factors associated with the large-scale death of Firs in three districts: the Pürglitz district of Bohemia, the west Moravian hill lands, and the woodlands of the town of Kaschau in the adjoining area of eastern Slovakia. In Moravia the 'drying up' of the Firs was accompanied by infestation by *Cacoecia murinana*. In such cases the death of the trees generally occurred only where the insect had been present for about ten years. An epidemic of *Dreyfusia nordmannianae* was associated with the death of Firs in the Carpathian region. Although both insect species were present to some extent in the Pürglitz woodlands, it seems likely that other factors have been of greater importance here in causing the death of Firs, since similar symptoms appear also in uninfested areas. The sickly condition of the trees is possibly due in part to unsuitable site factors. The artificial planting of pure stands of Fir in the area has greatly favoured the two main pests of Fir and has eventually (after a successful first generation of trees) had an adverse effect on the suitability of the site for the further growth of this species.

45.3 (41.5) : 12.25–8 : 13.2. EIRE. **Report of the Minister for Lands on forestry for the period from 1st April, 1938, to 31st March, 1943.** Stationery Office, Dublin. [1944?]. pp. 65. [431].

Of the insect pests reported as causing damage in forest plantations the most important are the Pine weevil (*Hylobius abietis*) and other weevils; the Pine sawfly (*Diprion pini*) has caused severe damage to Scots Pine and *Pinus contorta*, while the attack by *Adelges* on Douglas Fir, which has been very severe in the past, appears to be decreasing appreciably. Other insect pests that are reported to be widespread and important are the Pine shoot moth (*Evetria buoliana*), the Oak leaf roller moth (*Tortrix viridana*), the large Larch sawfly (*Lygaeonematus erichsoni*), the Larch shoot borer (*Argyresthia* sp.), the Ash bud moth (*Prays curtisellus*), and the St. Mark's fly (pp. 33–4).

45.3 : 13.2 : 23.27 : 12.25–8. SMITH, R. **Mites injurious to western shade and ornamental trees.** *Proc. 10th west. Shade Tree Conf.* 1943 (57–62). [432].

Throughout the eleven western States of America mites are by far the most prevalent type of pests of shade and ornamental trees. The long dry summers favour their multiplication and persistence, whereas in other parts of North America they are kept under control by frequent rains. In this paper some account is given of the commonest mites, including a number of species of *Tetranychus* and *Paratetranychus*. Highly refined oil spray is effective in their control; it should be applied with sufficient thoroughness to wet all parts of the tree. With the several species of mites which affect the upper side of the leaves, it is important that sufficient spray be applied to produce an oil film on the top side of the leaves in the higher part of the tree. Drenching infested trees with a forceful coarse spray of water from a garden hose is an effective means of control where trees are not too large and water under pressure is available. The advantage of oil spray lies in the fact that the mites in all stages are killed outright and many, if not all, of the eggs are destroyed.

45.3 : 12.26–8 : 13.15 : 13.2. GARDNER, J. C. M. **Entomological notes.** *Indian For.* 71, 1945 (88–9). [Forest Research Institute, Dehra Dun.] [433].

The Cerambycid beetle, *Nupserha antennata*, does not appear to be of great value in controlling the common Indian weed, *Bidens pilosa*, since attacked plants produce seeds in profusion.

Insect pests of *Cryptostegia grandiflora* in India include *Aphis gossypii*, *A. nerii* and *Euploea core*. A larva of *Monochamus nivosus* was obtained from a dead cutting of *Cryptostegia* which showed Cerambycid galleries beneath the bark, but this species may be only a secondary borer in dead or dying stems.

A note is included on the Bostrychid, *Dinoderus bifoveolatus*, which attacks Cane and may also cause serious damage to the sapwood of broadleaved trees and to Bamboos.

45.3 (47.1) : 13.2. LOVÁSZY, P. Sur Kenntnis der Schlupfwespen einiger schädlichen Rindenkäfer. **[A contribution to the knowledge of the hymenopterous parasites of certain injurious bark beetles.]** *Ann. ent. fenn.* 7, 1941 (194–204). *Abstr.* in *Z. PflKrankh.* 53, 1943 (306). [G.] R.A.E. 33A (11–2). [434].

War conditions have led to the accumulation of much dead and dying timber in eastern Finland, which may encourage outbreaks of bark beetles. The author therefore investigated the extent to which these and other bark insects are parasitised in Pine and Spruce. The parasites bred were *Ephialtes* (*Pimpla*) *terebrans*, Tatz., from *Pissodes validirostris*, Sahlb.; *Coeloides abdominalis*, Zett., from *Myelophilus* (*Blastophagus*) *piniperda*, L., *Pissodes pini*, L., *P. harcyniae*, Hbst., and *Ips proximus*, Eichh.; *C. melanotus*, Wesm., and *C. bostrychorum*, Giraud, from *P. pini*; *Allodorus semirugosus*, Nees, from *P. harcyniae*; *Eurytoma rufipes*, Wlk., from *M. piniperda* and *Hylastes* (*Hylurgops*) *palliatus*, Gylh.; *E. curculionum*, Mayr, from *P. validirostris*; *E. ischioxanthus*, Ratz., from *Ips* (*Pityogenes*) *chalcographus*, L., *I.* (*P.*) *bidentatus*, Hbst., and *I.* (*P.*) *quadridens*, Htg.; *E. nobbei*, Mayr, from *Magdalis violacea*, L.; *Rhopalicus suspensus* Ratz., from *P. harcyniae*, *Myelophilus piniperda* and *I. typographus*, L.; *R.*(*Pteromalus*) *azureus*, Ratz., from *I. proximus*, *I.* (*Pityogenes*) *bidentatus*, and *H. palliatus*; and *Rhoptrocerus* (*Pachyceras*) *xylophagorum*, Ratz., from *I. chalcographus*, *I. bidentatus* and *H. palliatus*.

45.3 (485) : 12.26–8 : 13.2. BUTOVITSCH, V. Undersökning över en härjning av videspinnaren (*Stilpnotia salicis* L.) i Västra Uppland. [**An investigation of an outbreak of the Satin Moth** (***S. salicis***) **in West Uppland.**] *Medd. Skogsförsöksanst. Stockh.* No. 33, 1944 (267–94). [Sw.g.] R.A.E. 33A (32). [435].

An outbreak of *Stilpnotia salicis*, L., occurred on Aspen (*Populus tremula*) in two neighbouring forest areas in central Sweden in 1939–41, and the observations recorded in this paper were made during the second half of the period. Brief accounts are given of the distribution, morphology of all stages and previous outbreaks in Europe of this moth, together with lists of its food plants and natural enemies in Europe and North America. The observations on its life-history are supplemented by material from the literature.

Most of the defoliated trees put forth new leaves after about seven weeks, though some failed to do so and eventually died. It is estimated that about 20 per cent. of the trees over the whole area were killed by the outbreak.

45.3 : 12.26–8 : 13.2 (71.5–7) : 13.19. HAWBOLDT, L. S. **History of spread of the Beech scale,** ***Cryptococcus fagi*** **(Baerensprung), an insect introduced into the Maritime Provinces.** *Repr.* from *Acad. Nat.* 1, 1944 (137–46). [Dominion Entomological Laboratory, Fredericton, N.B.] [436].

The history of the spread of the Beech scale, *Cryptococcus fagi* (Baer.), in Canada since its introduction from Europe at some time before 1890, is described and illustrated with a map. The factors governing the rate of spread are discussed and the general condition of Beech in the Maritimes is described and illustrated. *Author's summary.*

45.3 : 12.26–8 : 13.2. HOLDHEIDE, W. Massenauftreten von *Mikiola fagi*, der Buchengallmücke, im Allgäu im Sommer 1941. [**Epidemic of** ***Mikiola fagi*****, the Beech gall fly, in Allgäu in the summer of 1941.**] *Thar. forstl. Jb.* 93, 1942 (676–81). [G.] [437].

Beech trees bearing galls of *Mikiola fagi* showed a marked diminution in leaf size and a general reduction in both height and diameter growth as compared with uninfested trees. It is possible that this insect may be one of the factors which render difficult the spread and natural regeneration of Beech at higher elevations.

45.3 : 13.15 : 13.2. GÖSSWALD, K. Die rote Waldameise und ihre Umwelt. [**The red forest ant and its environment.**] *Biologie* 11, 1942 (180–91). [G.] *Abstr.* in *Z.Pfl-Krankh.* 53, 1943 (317). [G.] R.A.E. 33A (15).

45.3 : 13.15 : 13.2. GÖSSWALD, K. Künstliche Vermehrung der roten Waldmeise. [**Artificial multiplication of the red forest ant.**] *Mitt. biol. Reichsanst.* No. 63, 1941 (44–6). [G.] *Abstr.* in *Z. PflKrankh.* 53, 1943 (320). [G.] R.A.E. 33A (16). [438].

The author considers that the red forest ant (*Formica rufa* L.) is an important factor in the prevention of outbreaks of forest insects in Germany. Attempts to breed this insect must be based on knowledge of its races, which differ in their ecology.

Breeding in the open is carried out in spring by means of chambers containing at least 50,000 workers, to which from 1 or 2 up to 50 or 500 queens, respectively, are added. A case is cited in which the population of *Diprion pini*, L. was practically eliminated in the area within reach of ants bred in this way.

47. COLLECTIVE INJURIES TO INDIVIDUAL TREE SPECIES

47 : 12.26–8 : 12.21 : 44.3. POMERLEAU, R. Les maladies de l'érable à sucre et leur prévention. **[Diseases of Sugar Maple and their prevention.]** *For. québec.* 9, 1945 (311–48). [F.] [439].

A general account of the diseases of the Sugar Maple (*Acer saccharum* Marshall). Amongst the organisms which attack this tree are *Nectria* sp., *Eutypella* sp., *Hypoxylon* sp., *Diatrype* sp., *Fomes igniarius*, *F. applanatus*, *F. connatus*, *Daedalea unicolor*, *Polyporus glomeratus*, *Hydnum septentrionale*, *Ustilina vulgaris*, and *Armillaria mellea*. Many of these diseases are the result of planting Maples on poor or unsuitable sites or are due to infection from other trees. Maple groves should be carefully examined from time to time and infected trees destroyed. The *Hypoxylon*, *Diatrype* and *Daedalea* cankers are usually caused by insolation and can be prevented by sheltering young trees on southern exposures from the direct sunlight.

5. MENSURATION. INCREMENT. YIELD

52. MEASUREMENT OF TREES AND TIMBER

52.4. *Measurement of Volume*

52.43.2 : 32.4. BLYTHE, R. H. **Saving by sampling.** *Timberman* 46 (5), 1944–45 (42–5, 80). [U.S. Division of Forest Economics.] [440].

The advantages of sample scaling are set out and a general explanation given of the principles involved. Three tables are given to indicate the correct number of logs to scale for different combinations of total value of sale, and cost of scaling per log. It is shown that to scale more logs than are indicated by the tables is uneconomic.

52.43.2. ZACH, L. W. **The application of sample log scaling in Region One.** *Res. Note Nth. Rocky Mt. For. & Range Exp. Sta.* No. 31, 1943. pp. 10. [441].

The minimum requirements for log scale sampling [cf. *For. Abstr.* 5 (204)] that are necessary for this method to be of practical use in U.S. Forest Region I are discussed and summarized with reference to size of sample, uniformity of universe, distribution of samples and accuracy required.

52.43.2. KEEPERS, C. H. **A new method of measuring the actual volume of wood in stacks.** *J. For.* 43, 1945 (16–22). [442].

The method described, which is quick, cheap, simple to apply, and gives results with less than 1 per cent. of error, consists in measuring, on a photograph, the proportion of air space to wood area plus air space on a number of equi-spaced, parallel lines across the face of the wood pile. [Cf. *For. Abstr.* 5(206).]

52.43.3. MEYER, W. H. **Volume-diameter ratios as a general basis for board-foot volume tables.** With comment by F. X. Schumacher. *J. For.* 43, 1945 (49–55). [443].

The method of using volume-diameter ratios in the construction of board-foot volume tables [cf. *For. Abstr.* 6 (50)] is here explored to determine the generality of its basic assumptions. The method was originally developed for use with Connecticut hardwoods and applied solely to the construction of tables in which merchantable length was used with d.b.h. to determine the contents of the trees. Its validity is here tested for various conifers, different log scales, degrees of utilization, and height classifications. On the whole, the author considers that the several theories are well substantiated as having a general application, and hence can be considered fundamental to volume relationship.

52.46 : 12.25 (73). ROBINSON, G. P. **A system for cruising Ponderosa Pine.** *Timberman* 46 (5), 1944–45 (128–30). [444].

In the method described one man works alone, mapping, pacing strip distance, and recording the trees thereon by species and volume. The latter is determined by measuring d.b.h. and height in logs to the 8-in. top d.i.b. of tree, and applying these data to a prepared volume table in which for each 2-in. diameter class the number of logs and corresponding volume are segregated according to site; after a number of measurements have been made the site can be determined by the distribution of the data; further height measurements are then unnecessary. Volume table figures are reduced by a percentage to allow for breakage and unmerchantable tops.

Instruments used on this type of cruise are: staff compass; Jacob's staff, with the Biltmore stick and Merritt hypsometer printed on it; 50-ft. diameter type; Abney level; tally register.

56. INCREMENT

56 : 12.25 (79.4). **Twenty years growth on a Redwood sample plot.** *J. For.* 43, 1945 (30–6). [445].

Growth data have been recorded on a one-acre plot in second growth Redwood (*Sequoia sempervirens*) on a high Site I on Big River in Mendocino County, California, the trees having been measured when 65, 75 and 85 years old. Yield at 85 years was found to be 223,034 bd. ft. of second-growth Redwood, 540 bd. ft. of Alder and 21,400 bd. ft. added to 5 old-growth residual Redwood, giving a grand total of 244,974 bd. ft. per acre or 2,878 bd. ft. per acre per year. The highest periodic annual growth was 5,074 bd. ft. for the second-growth Redwood alone in the decade between 65 and 75 years. At 65 years there were 273 trees per acre, while at 85 years there were 197 trees. The dominant trees (second-growth) reached 172 ft. in height and nearly 43 in. d.b.h. at 85 years. It is pointed out that the percentage of Redwood land of this high quality class is not large, Site II predominating in the commercial limits of the Redwood region.

56.02 : 07.7. DAUBENMIRE, R. F. **An improved type of precision dendrometer.** *Ecology* 26, 1945 (97–8). [University of Idaho, Moscow, Idaho.] [446].

The apparatus described enables an investigator to make studies of the seasonal course of diameter growth of a great number of trees simultaneously, with considerable accuracy and at very little expense for equipment (normally less than $20·00). The tips of 3 wood screws are screwed through the bark and about 1 cm. of the wood, leaving about 2 cm. projecting from the surface. The screws are arranged in triangular form and their heads form a plane fixed in position with respect to the outer layers of mature wood. A standard dial gauge is fastened permanently to a small platform which can be held against the screw-heads in making measurements. The spindle of the gauge strikes against a thin piece of metal fixed to the bark and the dial registers to 0·001 of an inch the distance between the fixed plane defined by the screw-heads and the surface of the bark. Only one dial gauge is needed, but each tree under study needs a permanent set of 3 screws.

56.02 (78.8) : 11.14. SCHULMAN, E. **Tree-rings and run-off in the South Platte River Basin.** *Tree-Ring Bull.* 11, 1945 (18-24). [447].

The author discusses tree-ring hydrology with particular reference to investigations based on increment borings of Douglas Fir (*Pseudotsuga taxifolia*) in the South Platte River basin in central Colorado. Cross-dating was generally very satisfactory. It is claimed that the preliminary index gives a chronology (1) of winters of drought, (2) less reliably, of wet winters, and (3) of general maxima and minima in precipitation and run-off. Various factors that reduce the apparent correlation between growth and recorded rainfall and run-off are listed and discussed.

56.02 (79) : 11.62. SCHULMAN, E. **Runoff histories in tree rings of the Pacific slope.** *Repr.* from *Geog. Rev.* 35, 1945 (59–73). [448].

A preliminary account of the possibilities of using dendrochronological data in studying the past history of water supply in the northern and southern extremes of the Pacific slope of the United States. For southern California a preliminary 465-year index has been developed that represents a first approximation to the history of seasonal precipitation and run-off in the southern Sierra Nevada and Coast Ranges. Apparently only a more comprehensive field collection of specimens is needed to provide a sufficient basis for computing long-time statistical characteristics of the fluctuations in available water supply in this region. Similarly, in the semi-arid Pacific Northwest, centuries-long tree-ring indices of precipitation can be applied to this problem.

56.03 : 12.25 : 11.14. MILLETT, M. R. O. **Rainfall and increment of Monterey Pine in the Australian Capital Territory.** *Leafl. Commonw. For. Bur. Aust.* No. 56, 1944. pp. 26. [449].

This bulletin describes an investigation into the relationship between rainfall and increment per cent. in basal area on an unthinned plot of Monterey Pine (*Pinus radiata*) during the period 1927–42. [cf. *For. Abstr.* 7 (57)]. It is concluded that of all the meteorological factors taken singly, rainfall is by far the most important, and that the increment and rainfall

curves for the area in question correspond as well as similar curves plotted by workers in other countries for Monterey Pine and other arboreal species.

56.3 (76) : 09.4. MESAVAGE, C. **Forest survey estimates of southern forest growth.** *Sth. Lumberm.* 169 (2129), 1944 (168–70). [450].

For purposes of quick reference, tables are given which summarize the current annual growth possibilities for each survey unit covered by the U.S. Forest Survey in the southern States. The tables deal with estimated net annual growth, net annual cordwood increment per acre, and net annual bd. ft. increment per acre.

6. MANAGEMENT. WORKING PLANS. SURVEYS

60. GENERAL LAND MANAGEMENT

60.3. *Management of Different Classes of Forest*

60.31 (43.1–5) : 98.1 : 66 : 24. MAHLER, O. Planification et exécution des coupes excédenaires dans le Reich Allemand. [**Planning and execution of excessive cutting in the German Reich.**] *Intersylva* 3, 1943 (343–61). [F.g.e.span.f.it.] M.E.W. [451].

The need for heavy excess fellings in recent years has brought about changes of fundamental significance in German forestry. The measures taken to meet these conditions are discussed in the present paper; these have been changed from time to time as the period of excess exploitation was prolonged beyond that of earlier estimates. The necessity of adjusting excess fellings to a longer period led to the establishment of improved plans for the imposition of felling duties and to the more accurate silvicultural direction of the fellings.

New developments in management have been concerned mainly with investigating sustained-yield capacity of forests and the potential supply of various sorts of timber; the creation of large working circles; greater freedom from the ideas of 'periodic block' and 'rotation age'; rational thrift with certain tree species and imposed assortments; and the opening up of forests to facilitate timber transport. In silviculture, the aim has been to facilitate obligatory fellings of immediate importance, to meet sudden peak demands in certain wood assortments and cause as little damage to the forest as possible, and, at the same time, to give due consideration to future timber requirements. In this connexion it is suggested that special attention should be paid to a thorough use of the possibilities of "tending" forestry, to the application of adequate silvicultural systems, to the intensified utilization of small areas, to the introduction of open stand systems, as well as to a considered application of artificial regeneration.

60.31 (43.1–5) : 24. LEIBER, L. Le Königswald comme exemple d'exploitation appropriée à la station et au moment dans la zone des pins de l'Allemagne du nord. [**The Königswald as a model for management in accordance with present circumstances and local conditions in the Pine zone of northern Germany.**] *Intersylva* 3, 1943 (362-73). [F.g.e.span.f.it.] M.E.W. [452].

The Königswald proper is a forest area of 831 ha. within the independent forest district of Königswald which was created in 1939. At that time the forest was poorly stocked, had little natural regeneration, and was seriously infested with fungous diseases. This paper gives an account of the measures taken to improve these conditions, to meet the demand for excess fellings, and at the same time to preserve the amenities of the forest.

60.31 (485) : 12.11.3 : 33.53–5. FLORIN, B. Stolp-huggning. Skona elitbestånd och elitträd. [**Post production. Spare élite stands and élite trees.**] *Skogsägaren* 20, 1944 (231–3). [453].

The importance is stressed of a proper system of felling of trees for posts in élite stands, or stands containing élite trees, so that individuals which are valuable for seed production for the new stands shall not be cut down. Excessive cutting for poles and posts impoverishes the stand and leads to a predominance of hereditarily inferior types which will pass on their undesirable features to the regenerated growth to which they give rise.

Race improvement should be promoted widely, as providing the breeder with material upon which high grade forest stands can be built up again. M. L. C. W.

60.31 : 12.25 (71) : 07.2 : 66. WESTVELD, M. **Silvicultural problems of Eastern Canada's pulpwood forests as viewed by an American forester.** *Pulp Paper Mag. Can.* 46, 1945 (332–4, 337). [Northeastern Forest Exp. Sta.] [454].

As the extensive Spruce-Fir forests of eastern Canada and the northeastern United States are the main source of raw materials for the pulp and paper industry they are a highly important factor in the social and economic well-being of the region, their perpetuation through sound management is essential to its continued industrial and agricultural development. A high proportion of these forests have been cut over at least once and in many cases there has been a marked deterioration and reduction in the growing stock of the second- and third-growth stands due to overcutting, careless logging, accumulations of slash, severe fires and insect epidemics. Fire and insects have caused more destruction of timber than has careless logging, and the Spruce budworm (*Cacoecia fumiferana*) alone has reduced the timber volume of the Spruce-Fir region by several hundred million cords.

In the Spruce-Fir region as a whole, conditions are favourable for the continuous production of pulpwood crops as the stands normally reproduce themselves readily and have a remarkable recuperative capacity. It is, however, necessary to develop techniques which will ensure that the generally abundant softwood advance growth will be preserved. For certain parts of the region, because of remoteness from markets, poor transport, low productivity, etc., only extensive forestry, involving protection and simple, inexpensive silvicultural measures, will be justified. On the other hand, intensive forestry practice would be justified on productive lands close to markets.

To put into effect intensive forest management for these forests requires specific information on: (1) methods of regenerating the various Spruce types; (2) causes and control of stand deterioration and methods for restoring productivity; (3) proper methods for cutting various types of Spruce stands; (4) means for increasing the growth rate and improving the quality of stands; (5) rate of growth of various Spruce types; (6) associated economic and utilization problems. Each of these points is discussed with reference to the information at present available and the studies that should be undertaken to obtain the additional knowledge necessary for developing sound management practices in these forests.

60.31 (71) : 76.1. CAMERON, D. R. **Forest management.** Woodland Section, Canadian Pulp and Paper Association, Montreal. [1945.] pp. [2]. [455].

In this conference paper the author discusses briefly the cost of forest management in Canada which he sums up as follows, this cost being pro rated against the total area of holdings:—

Protection	2·5 cents per acre
Roads	5·0 " " "
Silviculture	7·5 " " "
Total	15·0 " " "

It is suggested that if the cost of roads and half that of protection were borne by the public, the operator should be able to pay the balance, particularly as proper management may well double the yield of the forests and assure a perpetual supply of timber.

60.31 (79.5) : 22.1 : 23.1–2. MCCULLOCH, W. F. **Forest practices in Oregon.** *Bull. Ore. St. Bd. For.* No. 7, 1943. pp. 69. [456].

This bulletin was prepared by the Oregon State Forestry Department to be of assistance to landowners and logging operators in keeping their cutover land continuously productive. Three methods of cutting will permit natural regeneration in Northwest forests: clear cutting with seed blocks, clear cutting with seed trees, and partial cutting. These are described in some detail. The Oregon Forest Conservation Act is given as an Appendix to the bulletin.

60.31.1 (71.1) : 66. **B.C.'s first long range sustained yield project.** *W. Cst. Lumberm.* 72 (1), 1945 (60, 64). [457].

The British Columbia Forest Service has initiated Canada's first comprehensive and permanent programme for maintaining a long-term, sustained-yield scheme. Its object is to maintain forests at maximum productive capacity through selective cutting. In order to create a healthy forest and to ensure increased and continuous yield, all weak, overmature and beetle infested trees will be cut, retaining only young trees in prime condition. The timber involved is crown grant under direct control of the Government. Details of the programme are given.

60.31.1 (82). Bases racionales para la explotación de los bosques fiscales de pino en Misiones.

Defensa forestal y fomento de la industria maderera. **[Rationalization of the exploitation of the public Pine woods in Misiones. Forest conservation and the encouragement of the lumber industry.]** *Maderil* 17 (194), 1944 (3–5). [Span.] [458].

Recommendations on the exploitation of three areas of commercially important White Pine forest in Misiones, each about 1,000 ha. in extent, which the Argentine Ministry of Agriculture intends to dispose of by public auction.

60.31.2 : 76.2 : 97.2. REYNOLDS, R. R. **Farm forestry pays.** *Sth. Lumberm.* 169 (2129), 1944 (163–4). [459].

Since 1937 the Southern Forest Experiment Station has been carrying out a demonstration of the principles of farm forest management on a 40-acre site at Crosset Experimental Forest. The plan of annual cutting has been followed, each cut being the equivalent of a year's growth. The total of the products removed in 6 years from the whole 40 acres is 71·7 thousand feet Doyle rule of sawlogs, 215·5 standard cords of pulpwood, 124·3 standard cords of fuel wood, and 175 fence posts. The present volume per acre is almost exactly the same as in 1937; the small trees total 1·8 cords per acre less, but the large ones make 38 bd. ft. more per acre than in 1937. The financial results show a net return of $3·00 per acre if the owner does no more than sell the stumpage.

60.31.2 : 97.2 : 81. MATTOON, H. G. **Can the farm forester pay his way?** *J. For.* 43, 1945 (208–9). [Pennsylvania Forestry Association, Philadelphia, Penn.] [460].

The writer gives a brief sketch of the scope of knowledge desirable in a forester who is to advise farmers on forestry problems. Besides the usual knowledge of silvicultural and arboricultural methods, he should understand farming operations and practices, the relationship between tree insects and diseases and farm crops, and have a knowledge of marketing of such products as Christmas trees, nuts, holly, etc. The writer favours consulting foresters rather than public foresters for this work.

60.31.2 : 33.17 (76). EVANS, C. F. **The sawmill man and his neighbors.** *Sth. Lumberm.* 170 (2134), 1945 (38, 40). [U.S. Forest Service.] [461].

There are 16,000 sawmills in the southern United States which together cut 11 billion bd. ft. per annum. Forest actually owned by the mill companies produces only about 40 per cent. of this amount, and it is essential for the continuance of the industry that private owners should be encouraged to maintain good cutting practices and management of their forests.

60.31.2 : 07.1. HOLMBERG, L. A. **Visual aid in selling farm forestry.** *J. For.* 43, 1945 (128–30). [462].

A description of graphic aids to lectures designed to interest farmers in the proper management of their woodlots. The diagrams are cut out in flannel which will adhere to a flannel-covered blackboard.

61. SURVEYING. MAPPING

61 : 02.1. HARRISON, J. L. **A manual of surveying and drawing.** Forest Research Institute, Dehra Dun. [1944]. pp. [ii] + 133 + plates. [Indian Forest College and Indian Forest Ranger College, Dehra Dun.] Price Rs. 4/4. [463].

This manual is designed to take the place of one, now out of print, which has been used for many years past by the Colleges at Dehra Dun. The manual is elementary, but it has been drawn up in an attempt to meet the special and limited needs of Forest Officers. Sufficiently accurate survey can be carried out by means of the chain, prismatic compass, and plane table, and the theodolite is seldom used or required. The chapter headings are:—Surveying; Chain surveying; Optical square-obstacles in surveying; Angle measuring instruments and the taking of bearings; Traversing and chain and compass survey; Drawing office work; Plane tabling; Levelling; Contours; Determination of areas—enlarging and reducing plans.

61.3 (77.1). **Ohio forest survey: Manual of procedure.** *For. Publ. Ohio agric. Exp. Sta.* No. 71, (revised ed.) 1942. pp. 66. [464].

61.32. Aerial Surveys. Photogrammetry

61.32 : 32. HUDSON, D. W. **Application of aerial photography to logging operations.** *For. Chron.* 20, 1944 (262–9). [465].

This paper discusses the value of aerial photographs, used with a stereoscope, in supplying specific information to timber operators, in the preparation of operating plans, and in the location of motor, portage and hauling

roads, timber cuts, dams, camps and stream improvements.

61.32 : 07.7. SONLEY, G. R. **The monoscope: a new transferring instrument for use with air photographs.** *For. Chron.* 21, 1945 (43–4 + plate). [Dominion Forest Service, Ottawa.] [466].

The monoscope is an instrument for use in transferring data from air photographs to a map. It is similar in appearance to the duoscope [cf. *For. Abstr.* 2 (332)] but differs from that instrument in that superimposed images of the map and photograph can be viewed with one eye. The monoscope is light in weight, portable, simple to operate, can be adjusted for use as a stereoscope, and has a range of from $2\frac{1}{2}\times$ enlargement to $3\times$ reduction.

61.32 (71) : 43.1. JENKINS, F. T. **Relation of aerial survey and post-war rehabilitation.** *Timber of Canada* 4 (3), 1943 (17–23). [467].

This article is a plea for increased use of aerial survey and reconnaissance in Canadian forestry. It is calculated that one seaplane can photograph about 8,500 sq. miles in northern districts from break-up to freeze-up, on a scale of 1 : 31,680, which is adequate for preparing planimetric maps at scales of 1 in. = 1 mile or smaller. Cost of photography would be about $5·00 per sq. mile, including control lines and the use of 9 × 9 format Precision Camera with F 5·5 Ross lens and 6·06 focal distance; this assumes a 5-year contract to cover depreciation of new equipment. There would have to be added the cost of mapping from the photographs. Where estimates of standing timber are wanted, some ground survey work would be required. For undeveloped forest areas, a very general aerial sketching reconnaissance to delimit broad forest and other land types and to give rough estimates of timber quantities, would be the quickest and cheapest means for determining where aerial photography could be applied most advantageously for detailed information. The aerial reconnaissance would cost about $1·00 or $1·50 per sq. mile for the finished maps and reports, including flying and all other expenses. It would require forest engineers who were experienced aerial sketchers. An area of 100,000 to 150,000 sq. miles could probably be completed between break-up and freeze-up, with one aircraft for sketching and one for a ground party.

After such a general survey has been made and studied, certain areas can be blocked off for special surveys on a larger scale, where intensive forestry work is to be carried out, roads built, etc. Road building should always be preceded by aerial survey to avoid expensive errors.

A scheme of aerial forest-fire detection and suppression, to be organized for the various provincial governments, is described. Some provinces and parts of provinces, e.g. New Brunswick, are not suitable for aerial fire suppression because of lack of sufficient landing places, but Northern Canada on the whole is suitable.

64. DESCRIPTION OF SITE.

ASSESSMENT OF SITE AND STAND QUALITY

64 : 12.25 : 21.1–2 : 12.19. MILLETT, M. R. O. **An example of the change of a forest site due to irrigation.** *Leafl. Commonw. For. Bur. Aust.* No. 58, 1944. pp. 12 + dgm. [468].

The site described is a plantation plot of Monterey Pine (*Pinus radiata*) established at the central research station at Canberra in 1937 for the study of growth and microclimate. A small section of the plot is irrigated and measurements have shown that during the period 1937–42 the height increment of the watered trees has been 3–4 times, and their girth increment 3–6 times, as much as that of the control trees. Irrigation has also effected a marked change in the ground cover, a dense and varied vegetation including persistent natural regeneration of Monterey Pine becoming established on the watered section in contrast to the sparse vegetation and transitory regeneration on the control area. Irrigation is shown to have favoured introduced more than indigenous species; the introductions came from the plantings of exotic trees and shrubs in the Federal Capital, the seeds being distributed by birds.

The relative importance of light and soil moisture under a forest canopy are discussed and illustrated by the observation of plants in trenched, irrigated and control plots established on this site. While it is evident that water plays the more important part in temperate latitudes and is essential for the survival of regeneration and ground cover, sufficient light is necessary if they are to thrive.

64 : 12.25 : 12.19.23. BRITISH COLUMBIA. **Report of the Forest Branch for the year**

ended December 31st, 1944. King's Printer, Victoria, B.C. 1945. pp. 79 + plates. [469].

In a preliminary study of the possibilities of using ground vegetation as an index of site quality, 165 plots were examined in all age groups of second-growth Douglas Fir, representing a range of sites from good to poor. There was found to be a regular sequence of plant communities with change in environment from excessively moist to excessively dry conditions. The plots were classified according to age-height growth relationship of the dominant trees and the correlation established between vegetational communities and the age-height growth data suggests that if the latter is an index of site the former is also one (pp. 21–2).

66. POSSIBILITY. SUSTAINED YIELD. YIELD REGULATION

66 (47.1) : 60.31. Saari, E. Die Nachhaltigkeit der finnischen Forstwirtschaft. **[The principle of sustained yield in Finnish forestry.]** *Intersylva* 3, 1943 (518–27). [G.g.e.span.f.it.] M.E.W. [470].

According to the Finnish forest survey carried out in 1936–38, 37 per cent. of the forest area of the country is owned by the State, 1·5 per cent. by municipalities, 1 per cent. by ecclesiastical bodies, 7·9 per cent. by industrial concerns, and 52·6 per cent. by private individuals. That part of the forest area owned by the State, ecclesiastical bodies and industry is managed according to working plans on the basis of sustained yield. However, relatively small forest properties, such as those in private ownership, are difficult to manage on such a basis. Although private owners are not required by law to prepare working plans for their holdings, exploitation is not left entirely to the owner's discretion; while the yield from these private forests is considerably below the potential capacity of their respective sites, it is suggested that, on the whole, their treatment is not incompatible with the principles of sustained yield.

On the basis of figures obtained from the general forest survey of the country and analysis of timber utilization statistics, it is estimated that on the whole, increment and loss balance each other, and that therefore the volume of growing stock has been kept at a constant level. It is estimated that by suitable measures the annual increment of the forests of Finland could be nearly doubled compared with the present figure.

7. FOREST ECONOMICS, VALUATION, AND FINANCE

71. FUNDAMENTAL ECONOMIC PRINCIPLES

71 (494). Schädelin, W. Théorie du rendement net du sol et sylviculture. **[Silviculture and the theory of highest interest.]** *Intersylva* 3, 1943 (253–66). [F.g.e.span.f.it.] M.E.W. [471].

The theory of highest interest on soil, which is accepted by most economists, has always been treated with considerable reserve by practical foresters. The author suggests that this theory could only have been evolved for areas where the forests are mainly on flat, low ground. In mountainous regions, the rôle of the forest in protection, soil and water conservation, and in social economy (e.g. provision of litter, fertilizers, grazing, forage)—factors which are ignored in the theory of highest interest—is readily apparent. Also, it is pointed out, some of the principles on which the theory is based are of disputable validity. The writer's final conclusion is that the forest is of all things the least able to adapt itself to a capitalist economy. Production must be considered as the most important economic object of forestry, and a compromise between silviculture and the theory of highest interest on soil is impossible.

72. GENERAL PROBLEMS OF PROFIT AND LOSS

72 : 66 : 98.1. Köstler, J. Die Bedeutung der Mehrfällungen (Übernutzungen) für die Regelung der Holzpreise. **[The importance of excess fellings for the regulation of timber prices.]** *Intersylva* 3, 1943 (528–35). [G.g.e.span.f.it.] M.E.W. [472].

The relation between excess fellings and the regulated price of timber is discussed with reference to the following two questions: (1) What are the considerations to be kept in mind when fixing adequate timber prices? (2) How can the influence of excess exploitation on timber prices be analysed? It is considered

that over-exploitation generally justifies an increase in the price of timber.

76. MANAGEMENT STATISTICS

76.3 : 22.14.2 : 56.04. HEIBERG, S. O. **Does economic cutting pay?** *J. For.* 43, 1945 (109–12). [New York State College of Forestry, Syracuse, N.Y.] [473].

In this paper the author supplements a previous article entitled 'Cutting based on economic increment' [cf. *For. Abstr.* 4 (197)] by a specific example of the application of the method to a stand of White Pine in the Pack Forest at Warrensberg, N.Y. During the 5 years following a cutting that removed 47 per cent. of the board-foot volume, the stand grew at the rate of 4 per cent. compound interest in cubic foot volume, 4·5 per cent. in board-foot volume, and 6·4 per cent. in net stumpage realization value. The author believes that in another 15 or 20 years, after several more 'economic cuttings', the entire stand should be reproduced by the shelterwood method.

8. ADMINISTRATION

82. LABOUR QUESTIONS

82 (485) : 07.1. WALLNER, O. Om yrkesutbildning av skogsarbetare. [**Training of forest workers.**] *Skogen* 30, 1943 (301–3). [Sw.] [474].

During 1943 an experiment in the training of prospective forest workers was conducted by the Mo and Domsjo A.-B. The course lasted twelve weeks (January to April), and was completed by 11 of the original 15 pupils undertaking it; their ages ranged from 16 to 21 years.

The chief aim of the course was to give practical training in felling. This included the correct hand movements in the manipulation of tools, and accuracy in working up of usual assortments of logs for floating. Later, instruction was given in the cutting of firewood. In addition, each pupil received thorough instruction in saw filing and the care of tools.

Part of the time was devoted to instruction in theory with reference to scaling, general rules for the care of timber, and prevention of accidents; a course in first aid was given.

For work done the pupils received payment at agreed piece rates. The average output varied according to age from 50 to 74 cu. ft. per day. In addition, the pupils received from the firm a training contribution according to the standards adopted in the provincial labour committees' felling courses for unskilled workers—that is, 1·50 kr. per day for the first 60 working days and 1 kr. per day subsequently. The pupils were paid travelling expenses from and to their homes. R. P. J.

82 (485) : 91.8. NYSTRÖM, B. Arbetsförtjänsterna i skogarna 1924–44. [**Earnings for work in the [Swedish] forests, 1924–44.**] *Skogen* 32, 1945 (90–1). [Sw.] [475].

9. FOREST POLICY

90. GENERAL PRINCIPLES OF FOREST POLICY

90 (410). CHAMPION, H. G. **A four-year plan for agriculture—III. The claims of British forestry.** *Ctry. Life* 94, 1943 (854–6). O.B. [476].

The article gives a review of the Forestry Commission's Report on Post War Forest Policy [cf. *For. Abstr.* 5 (211), 6 (54)] and suggests aims for a first 5-year period after the war. These include:—

(1) To train at least 200 men to University degree standard, and 1,500 foresters for employment in Britain in State and private forestry.

(2) To survey the whole woodland resources of the country in some detail.

(3) To afforest 182,000 acres of new land and replant 183,000 acres of State forests, together with a large amount of building and road construction.

(4) To dedicate 1,000,000 acres of privately owned woodland to timber production with approved management plans for at least half this area; to replant 120,000 acres of privately owned woods and organize an advisory service, pest control, and co-operative supervision and management.

(5) To build up an efficient organization for

improved extraction, conversion and marketing of forest produce, largely on co-operative lines.

(6) To carry out essential research work on a much increased scale, with more attention to the silvicultural, economic and management problems of existing woods. This work must be done by the State.

(7) To constitute 10 new forest parks.

90 (410) : 98.2. **Forest policy and the home timber industry.** [Federated Home Timber Associations (England and Wales)]. 1945. pp. (4). [477].

This leaflet briefly reviews the British timber situation, and suggests that the following steps should be taken to improve it:—The establishment of a new Forest Authority with wide powers and a guarantee of continuity of policy; the closest collaboration of all those associated with growing, converting, and marketing of timber; facilities to the home timber industry to import logs and sawn timber, to enable it to keep men in steady employment in the years of shortage of native supplies; replanting of all derelict woodlands; reservation of young plantations and healthy growing timber until the trees reach maturity; powers to have timber put on the market as it becomes mature, so as to provide regular supplies to the mills; powers for the Forest Authority to purchase areas of immature woodland which come on the market.

90 (410 : 44). COULON, J. P. **British and French forest policy.** *Quart. J. For.* 39, 1945 (11–7). [478].

About one-fifth of the area of France is covered by forest and, of this amount, about one-third is state or communal forest, managed by the Forest Department and brought under a system of regulation which fixes for each forest the volume or the area to be felled annually, so that the value of the forest always remains about the same. Private forests are quite unregulated and the owners are free to manage them in their own way.

The output of home-grown timber amounts to about two-thirds of the national requirements, but there is an excessive output of firewood. This disproportion arises from the fact that coppice and coppice-with-standards, which provide mainly firewood, represent about 60 per cent. of the useful wooded area. To solve the French problem the following measures would therefore be necessary:—

(1) In the private forests increase the rotation of coppice and coppice-with-standards.

(2) Convert some coppice into coppice-with-standards, and some coppice-with-standards into high forest.

(3) Afforest bare land.

The Vichy Government, by the law of August 13, 1940 (now repealed), made an attempt to carry out the third of these measures with a scheme involving the planting of 250,000 to 300,000 ha. In 1942 10,000 ha. had already been afforested.

Provisions for the prevention and fighting of fire and effective control of private forests are the chief necessity for increasing the proportion of timber to total forest products.

90 (54). INDIA. **Reconstruction Committee of Council: second report on reconstruction planning.** Manager of Publications, Delhi. 1944. pp. 57. [479].

Under the section of this report dealing with forests is set forth a recommended post-war forest policy which is under consideration by the Government of India. This policy is based on the following salient points: the rehabilitation of Government-managed forests to compensate for advance fellings during the war; the campaign against erosion; the extension of afforestation. 'Of the matters calling for policy decisions, the most important aspect of post-war forest policy is correct land management to minimize run-off, floods and erosion both inside and outside forest land, and the afforestation, naturally or artificially, of the dry belt below the 30-in. rainfall line. The second, but almost equally important, problem is the provision of small timber and fuel for the 'ordinary village agriculturist', free or at low rates, both to provide for his direct wants and to release cow-dung for manure'.

90 (71.1) : 66. SIMPSON, S. M. **Sustained yield policy for forest industries of interior British Columbia advocated.** *B.C. Lumberm.* 29 (1), 1945 (31–2, 43–4). [480].

In this brief submitted to the Sloan Commission on forestry at Kelowna, B.C., the writer emphasizes the need for placing forestry in the Interior of British Columbia on a sustained yield basis, discusses the problems involved, and makes recommendations on the steps to be taken in establishing a policy with sustained yield of forest resources as its main objective.

90 (94) : 98.1. LANE POOLE, C. E. **Australian forest policy.** *Aust. Timb. J.* 10, 1944 (465–73). [481].

Australia has 10½ million acres of forest land of sufficiently high quality for permanent management: this should be ample to serve a population of 20 millions, but, owing to excessive overcutting and fire devastation, production is one-sixth what it could be and even that means overcutting with the present forest capital.

Steps that are necessary for the rehabilitation of Australian forests include: reduction in timber cutting; adoption and expansion of improved fire-protection measures; extension of softwood plantations, the indigenous forests being mainly hardwoods; the adoption of the Henderson community forest scheme; revision of timber tariff; increase in number of trained foresters.

91. SOCIAL AND ECONOMIC SIGNIFICANCE OF THE FOREST

91 (71.4) : 12.19 : 98.1. LEBLEU, J. La forêt dans l'économie de l'ouest de Québec. **[The forest in the economy of western Quebec.]** *For. québec.* 9, 1945 (137–67). [F.] [482].

The area dealt with in this article consists of some 25 thousand sq. miles, of which 96·7 per cent. is forest land. There are 3 main forest zones:—(1) South of lat. 47° N. is the zone of mixed woodlands. The old forest is characterized by the presence of *Pinus strobus* and *Tsuga canadensis*; this is replaced, after felling or fire, by *Picea glauca, Abies balsamea, Pinus banksiana* and tolerant broadleaved species. (2) Between lat. 47° and 48° N. is a transition zone of *Pinus strobus, P. resinosa, P. banksiana, Picea glauca*, giving way further north to *Picea mariana* and *Larix laricina*. (3) North of lat. 48° N. is the zone of conifers where *Picea mariana* occupies 60 per cent. of the area.

Figures are given of estimated stock, and the necessity of further inventories is emphasized. The growth of the mining industry in the region is increasing the demand for large quantities of timber, and it is estimated that the requirements of this industry in the next 10 years will be about 90 million cu. ft. It is suggested that special forest reserves should be formed to meet this need. Possibilities of the establishment of forest colonies, and the demands of tourist traffic are also considered.

91.1. *Rural Preservation. Reserves. National Parks*

91.1 (410) : 12.19.2 : 60.3. TANSLEY, A. G. **Our heritage of wild nature: a plea for organized nature conservation.** Cambridge University Press. 1945. pp. viii + 74 + plates. Price 7*s.* 6*d.* [483].

The thesis of this book is that planning for the preservation of rural beauty in Britain must be directed to the deliberate conservation of much of the native vegetation, since this is an essential element of natural beauty, and that such planning must be balanced and harmonized with land utilization for agriculture and forestry: further, that to conserve the native vegetation intelligently and effectively it is necessary to understand its nature and behaviour under different conditions, an understanding that is gained through the science of plant ecology. Chapter 5 deals with native British woodlands, and it is urged that as many as possible of the still existing Oak woods should be preserved. There is no reason why some of them should not be made productive by proper management, and they would regenerate themselves if rabbits and voles were kept down. Beechwoods should be protected by insisting on selective cutting only; it is quite possible to manage them so that the valuable timber can be regularly used without compromising their beauty or their scientific interest. Other types discussed are the pure Ash stands on limestone, Alder woods in the fenland, Birch woods and Pine woods in the Highlands.

91.1 (71.3 : 77.6). CHAPMAN, H. H. **A factual analysis of the Quetico-Superior controversy.** *J. For.* 43, 1945 (97–103). [484].

Since 1925 there has been a controversy over a project to dedicate part of the Quetico-Superior region (along the international border between Ontario and Minnesota) for a memorial to world war veterans of both countries, to be devoted to recreational uses as an international playground, principally for canoeing and camping. The writer reviews the history of the project and the principal obstacles to its accomplishment. Much of the United States part of the area belongs to the State of Minnesota, and most of the Canadian part to the Province of Ontario, and no international treaty made on the subject would be binding on the state and provincial governments concerned, in the matter of conservation of resources, etc. The conclusion he draws is that all interested organizations and persons should concentrate on the preservation of the roadless area in Superior National Forest and drop the greater Quetico-Superior scheme of 10 million acres.

91.3. *Influence of the Forest on the Environment*

91.3 : 11.62.1 : 23.3. GOGUEL, J. Sur une influence possible du reboisement sur les glissements de terrains. **[On a possible effect of afforestation upon landslides.]** *C.R. Acad. Sci. Paris* 216, 1943 (124–5). [F.] P.R. [485].

In the southern part of the French Alps many important slopes have been artificially reforested during the last 50 years in order to regulate streamflow and diminish erosion caused by run-off. There is, however, some reason to suppose that under certain conditions the control measures may also facilitate landslides. A clear example may be observed at Brette, north-east of Luc-en-Diois, an already fairly old reforestation on Oxford marls; a recent landslide, still in course of evolution, and certainly later than the reforestation, is reported from there. Reforestation, therefore, whilst it can be only advantageous on calcareous soils, should be undertaken with caution on clay soils.

91.4. *Value of the Forest in Hygiene and Recreation*

91.4 (43.1–5). LEONARD, H. L'adaptation de la forêt dans la zone de plaisance du Grand Berlin. **[Transformation of forests in the recreation area of Greater Berlin.]** *Intersylva* 3, 1943 (386–98). [F.g.e.span.f.it.] M.E.W. [486].

An account of the development planned for after the war in the woodland areas round Berlin, with a view to combining productivity with recreational facilities.

91.5. *Value of the Forest for Colonization*

91.5 (71.4) : 91.8. WILSON, J. O. **Our forests in relation to our social existence.** *For. québec.* 9, 1945 (53–67). [E.] [487].

The article begins by giving a brief review of the forest resources and labour requirements of Quebec, and goes on to sketch a plan for a forest colony on the north shore of the St. Lawrence River, based on the reservation of between one and two square miles of forest for each family and the conception that the forest will provide a complete living for the forest colonist. The need for further research and increased educational facilities is stressed.

91.8. *The Forest as a Source of Employment and Income*

91.8 (71) : 94.4–5 : 94.12. AUDEN, A. J. **Forest settlement—a national necessity.** *For. Chron.* 21, 1945 (22–9). [488].

This paper stresses the need for settlements in Canada and lists some of the principles which should govern their establishment, which include careful choice of settlers, provision of amenities and living conditions at least as good as those of the oldest and best established farming communities, full-time employment and adequate income, freehold right to farm homesteads after a period of probation, careful choice of location, sound finance. Forest settlement projects should not be undertaken until intensive surveys of the project area have been made and incorporated into the detailed working plans—surveys of forest capital and forest growth, soil, wild-life, water, geology, power resources, roads and existing and potential markets for material and labour.

92. FOREST LAW

92 (497.2). SIRAKOW, G. Les bases de la législation forestière en Bulgarie. **[Basic forest legislation in Bulgaria.]** *Intersylva* 3, 1943 (60–76). [F.g.e.span.f.it.] M.E.W. [489].

The article gives a fairly detailed account of the general Forestry Law which came into force in Bulgaria in 1925 and consists of 211 articles divided into nine chapters. Supplementary forestry legislation is not dealt with.

92 (931). BOARDMAN, W. **New Zealand forest legislation.** *N.Z. J. For.* 5, 1942–44 (50–6). [490].

A list of references omitted from a previous synopsis [see *For. Abstr.* 3 (336)], but which are of value with reference to New Zealand forest law.

94. FOREST OWNERSHIP

94.11 (76) : 60.31. KIRCHER, J. C. **Rebuilding a resource: it pays on the southern National Forests.** *Sth. Lumberm.* 169 (2129), 1944 (137–9). [491].

A general review of the condition and management of, and returns from, the National Forests in the southern United States. Beginning in 1911 with a small nucleus of lands reserved from the public domain (mostly in Arkansas and Florida), this system of National

Forests has been built up through purchase of lands in the open market. Within the 24 forests of the Region there are now about 9 million acres of Government-owned land. Most of this acreage was cut over at the time of purchase and the task of bringing it into full timber production presents many difficulties. Much of the development work was done between 1933 and 1941 by CCC labour; this enabled it to be done more quickly than would otherwise have been the case. Selective cutting of virgin stands has hitherto provided most of the annual cut. Second-growth forest is now nearing merchantable size in many stands, but more than half the National Forest acreage consists of stands too young to be cut over for pulpwood. The total cut in 1944 was 327,871 thousand bd. ft.

94.3 (73) : 60.31.2. PERRY, E. L. **Neither is black.** *J. For.* 43, 1945 (6–8). [492].

The writer summarizes the opposing views of industry and the Forest Service in regard to public regulation of cutting on privately owned forest in the United States, and reaches the conclusion that such regulation is not only inevitable, but also in the best interests both of the public and of industry itself.

94.3 (73) : 60.31.2. CHAPMAN, H. F. **How urgent is federal forest regulation?** *J. For.* 43, 1945 (3–5). [493].

A discussion of the controversy over the proposed federal regulation of privately owned forest in the United States. The writer believes that the Forest Service has made a tactical error in singling out a few large owners as the chief offenders against sound practice, and that the first necessity is to convince the large number of farmers and other small owners of the necessity and reasonableness of regulation. For this reason, he believes that state regulation would be more efficacious than federal control.

94.32 (931). CLARK, A. F. **Some aspects of the legal position of forests upon mortgaged land in New Zealand.** *N.Z. J. For.* 5, 1942–44 (29–35). [494].

Points dealt with in this article include the rights of the mortgagor, rights of the mortgagee, rights of the mortgagee in possession, and forests on leasehold land.

94.4 (71.3) : 91. AUDEN, A. J. **Nipigon forest village.** *For. Chron.* 20, 1944 (209–61 + plates). [495].

A detailed prospectus for a co-operative forest community to be located on the shore of Lake Nipigon in the Thunder Bay District of Ontario. The project would be 'based upon the co-ordinated development of a forest products industry, hunting and fishing lodge with outlying cabins, subsistance farming and horticulture, handicraft shops and finished woodwork, probably also fur farming, commercial fishing, and perhaps a quarry—all these activities to be integrated and administered by an executive board and a manager, with marketing of production handled by a Forest Products (Producer) Co-operative Association'.

96. POLICY REGARDING PROTECTION FOREST AND DEFORESTATION

96 (86) : 23.21. POZO RODRÍGUEZ, P. DEL. Reforestación de la hoya del río Navarco (Caldas). **[Reforestation of the basin of the River Navarco (Caldas).]** *Tierras y Aguas* 6 (65/66), 1944 (3–19). [Span.span.] [496].

The author stresses the importance and urgency of reforestation in the Caldas region in order to prevent soil erosion and regulate the water supply, and suggests the creation of a plan which will take into consideration the development of the region as a whole, including schemes for hydraulic power. He maintains that a Forest Service should be set up or that the Department of Agriculture should at least be so organized as to be able to deal effectively with forest policy since it affects the vital interests of the community.

The species suggested for use in afforestation are mainly Pines but a few trees from other genera (*Abies*, *Taxodium*, *Sequoia* and *Cedrus*) are included.

97. POLICY REGARDING THE RELATION OF THE FOREST TO AGRICULTURE, PASTURE, AND INDUSTRY

97.1 (66.9) : 61 : 23.1 : 12.26–8. MACKAY, J. H. **On the rôle of regional survey in administration and land planning.** *Farm and Forest* 5, 1944 (172–8). [497].

The writer urges that a standard questionnaire should be devised for the purpose of collecting material for regional surveys as a basis of administration and land planning in tropical Africa, and gives an outline indicating

the subjects and details which appear to be most required. Analysis of the surveys is a task for the specialist, but it is suggested that the collection of material could well be done by administrative officers. As an example of one of the many problems to which this method would be applicable, he takes the case of Iroko (*Chlorophora excelsa*) in the densely populated palm belt of Owerri Province in Nigeria. Little forest now remains, but there are many solitary, overmature trees. A preliminary survey of thousands of scattered trees or groups of trees is advocated in order to study what natural regeneration does occur under a large variety of conditions, and, from an analysis of the data so obtained, to determine the factors which appear to encourage or inhibit regeneration, thus possibly finding an effective regeneration technique in a period of months.

97.2–1 (66.9) : 96. MILLER, R. **A suggestion for post-war settlement of soldiers of the northern provinces of Nigeria.** *Farm and Forest* 5, 1944 (160–6). [498].

This article presents a draft scheme for land settlement in Nigeria, stressing the need for close liaison with the Departments of Agriculture and Forestry. A part of such a settlement would be firewood plantations, either as windbreaks on the perimeter of farms, as coppices on otherwise useless land within the settlement, or in large blocks just outside the arable area. In clearing land, useful trees should be spared and their numbers systematically increased thereafter.

97.2 (73) : 60.31.2 : 32 : 98.2. WESTVELD, R. H., and PECK, R. H. **Forestry in farm management.** John Wiley and Sons, Inc., New York. Chapman and Hall, Ltd., London. 1941. pp. ix + 339. Price $3·00. [499].

This book is designed to give students in agricultural and teachers' colleges, county agricultural agents, teachers of vocational agriculture, and farmers in the United States a practical knowledge of the value and usefulness of farm forests, the methods of handling them, and the means of making them real farm assets. The 15 chapters deal with the fundamentals of forest management and the harvesting and marketing of forest products, while the Appendices give in condensed form basic information, not elsewhere readily available, which is needed in working out local problems. These are: A. Common and scientific names of trees. B. Habits and requirements of the important tree species in U.S. farm forests. C. Some damaging forest insects and diseases. D. Log rules. E. Sample volume tables. F. Examples of analysing data for farm-forest plans. G. Farm-forest financial records. H. Federal Forest Experiment Stations.

97.2 (79.6) : 60.31.2. TUMELSON, F. O., and EDWARD, M. B. **Farm woodlands in northern Idaho.** *J. For.* 43, 1945 (27–9). [500].

The 550,000 acres of farm woodland in northern Idaho form 20 per cent. of all farm land. In the past they have been little used except for timber for farm use, and as a result are now for the most part overstocked. The writers believe that under good forest management the present annual increment could be doubled and quality much improved, and that, provided markets improve, farmers would be glad to co-operate in such management.

98. THE TIMBER MARKET

98.1 (43.1–5). BOULTON, E. H. B. **The forests of Germany: what they can supply on reparations account for the U.K.** *Timb. Tr. J.* 173, 1945 (7–8). [501].

The pre-war forest area of Germany was about 23½ per cent. of the total land area of the country. The tendency has been to encourage the growth of conifers and to reduce the area under hardwoods, the percentage before the war being 67 per cent. softwoods and 33 per cent. hardwoods. The author gives a brief review of German forests and their management.

98.1 (47.3) : 32. NEVZOROV, N. V. Perspektivy razvitiya lesoeksploatatsii Narkomlesa SSSR v basseyne Kamy. [**Prospects of the development of timber exploitation by the People's Commisariat for Forests of the U.S.S.R. in the basin of the River Kama**]. *Lesnaya Prom.* No. 7–8, 1944 (3–8). [Russ.] [502].

Exploitation of the forests in the basin of the River Kama in central Russia is important for three reasons: (1) There is a high demand for forest produce in the area itself; (2) timber can easily be floated downstream to the almost treeless region of the lower and middle Volga; (3) as there is a demand for all kinds of wood, including even Aspen firewood, clear felling may be practised.

The total timber resources of the basin of the

Kama and its tributaries amount to 1662 million cu. m. The average volume per ha. is 175 cu. m., of which 65 cu. m. consists of commercial timber. It is possible to float timber from the Kama basin for 5 months each year. Up to the present, exploitation has been generally insufficient and irregular. The present demand for timber has led to plans for exploiting the less accessible and better stocked areas. The author indicates which areas it is intended to exploit first and gives data on their stocking. In some of these areas there already exist narrow-gauge railways for extracting the timber. In order to increase production, mechanized means of extraction are to be introduced where possible and the rivers prepared (e.g. by dams) for floating timber. Greater transport facilities and a bigger staff of permanent and seasonal workers will be required in order to carry out the new programme.

98.1 : 12.26–8 (59.1) : 32 : 31.41. SCOTT, C. W. **Burma Teak today.** *Wood* 10, 1945 (81–4). [Indian Forest Service (Burma).] [503].

Burma provides about two-thirds of the world's output of Teak, the total output from that country being about ½ million tons (of 50 cu. ft.) of round logs per annum. Half of this outturn comes from the Pegu Yomas between the Irrawaddi and Sittang rivers, an area of some 6,000 sq. miles in extent which, before the Japanese invasion, was almost entirely reserved forest and worked on sustained-yield basis by lessees or the Government department. Owing to the vastness of the Teak forests and to the lack of transport facilities, it is probable that the Japanese will have done little harm to the main Burmese Teak stands, and the resuscitation of the trade will depend on how soon labour, transport animals, equipment, and the mills can be reassembled.

For a tropical hardwood, Teak is relatively easy to extract and market. After it has dried on the stump for 2 or 3 years it is light enough to float, and it is naturally durable enough to be practically impervious to insects and fungi during the five or more years it is standing dead or lying in the river during extraction. This durability is almost certainly due to a toxic substance in the heartwood. Teak timber shows relatively little shrinkage in drying.

98.1 (72) : 09.4 : 09.7. MULLER, J. L., and DEUBER, T. P. **Mexico's timberland awaits development.** *Sth. Lumberm.* 169 (2129), 1944 (221-6). [504].

Because of climatic variations, Mexico produces the entire range of tree types, tropical hardwood, temperate hardwood and conifers, and, as a result of the ruggedness and inaccessibility of much of the terrain, the country still possesses ample reserves of virgin timber. Estimates of Mexico's standing timber vary from about 53,000 million to 97,000 million bd. ft. It is generally agreed that the country has about 50 million acres of potential commercial forests and that the forest cover is in general light. The major forest zones may be classified as follows:—

(1) Sea level to about 200 ft.: coastal tropical forests—Sea-grape, Mangrove, Palm, etc.

(2) 200 ft. to about 3,000 ft.: tropical hardwood forests—Mahogany, Cedar, Primavera, Ceiba, Walnut, Zapote, Conacaste, Lignum-vitae, Chicle, etc.

(3) 3,000 ft. to about 8,000 ft.: temperate hardwood forests—Oak, Alder, Ash, Walnut, Liquidambar, Laurel, Sycamore, etc.

(4) 8,000 ft. to upper tree limit: Softwood forests—Pine, Juniper, Fir, Cypress, etc.

(5) Arid and semi-arid desert forest: Northern half of plateau—Guayale, Candelella.

The lumber industry is backward and undeveloped, and improved transportation is necessary before it can be much expanded.

98.1 (94). KESSELL, S. L. **Post-war timber supply.** With discussion. *Aust. Timb. J.* 10, 1944 (429–44). [505].

The author reviews the timber consumption and supply of the Commonwealth from 1910 up to and including the period of the present war, and discusses immediate post-war timber requirements in Australia and the commercial exploitation of specialized wood products developed in war-time.

There will be a world-wide shortage of general utility timber and careful planning will be necessary to ensure that imports shall be complementary to, and not in competition with, local production.

Control has been necessary during the war and will be necessary after it, but inter-collaboration between Forest Services and timber users will result in benefit to national interests and joint advancement of all wood-using industries. An extensive programme for forest development and protection, regeneration and planting is necessary to prevent a collapse in

national timber supplies. Before the war Australia imported large quantities of softwoods and will remain a timber-importing country. Nevertheless she may develop a limited export trade in high quality hardwoods. Potential sources of timber available for importation are indicated.

98.1–2 : 09.4. STREYFFERT, T. Economie et commerce mondiaux du bois. [**World timber economy and trade.**] *Intersylva* 3, 1943 (76–92). [F.g.e.span.f.it.] M.E.W. [506].

The author takes as the basis of his article a survey, prepared for the Centre International de Sylviculture, of the turnover of the world's timber trade in the period between the two world wars. If sawn goods, squared timber and logs are considered as one group (construction goods), and paper, pulp and pulpwood as a second (paper industry goods), the period between 1925 and 1938 shows a decline of 35 per cent. for the first group and an increase of 45 per cent. for the second. The total of both groups, expressed in units of unworked timber, declined from 102 million cu. m. to 94 million cu. m.

Quality requirements are higher for construction timber than for pulpwood, and lowest for wood used for further chemical conversion. The fact that the importance of construction timber is diminishing, as compared with that of wood as a raw material for chemical industries, might lead to the conclusion that the production of timber should aim, to a greater extent than hitherto, at the quantitatively highest yield. It must be kept in mind, however, that the principal factor in determining forest production is not international trade but rather total consumption, and in that case two-thirds of timber production is still absorbed by the building trade.

Europe's timber balance shows an export surplus of 10–11 million cu. m. in units of unworked timber. A survey of the timber trade from 1880 to 1937 shows that Europe, with its gradually rising timber consumption, was at the same time increasing its exports. It is suggested that with the aid of an increased wood export from the forests of northern Russia, Europe's timber supply may be considered assured.

98.1–3 (485). LINDEBERG, E. Skogsbruket—en kärnpunkt i norrlandsfrågan. [**Forestry—one of the most important points in the Norrland question.**] *Skogen* 29, 1942 (110–3). [Sw.] [507].

The important part that forestry has played and will no doubt continue to play in all that concerns Norrland and its future is dealt with in this conference paper.

During its history the Swedish timber industry has experienced two production periods, the first being characterized for the most part by the production of sawn timber and the second by the production of paper pulp. The fact that timber of smaller dimensions could be utilized for pulp has been of great importance.

Future felling policy cannot be determined only by the position of forestry in Norrland, but must also be related to the requirements of the large timber industries located outside these provinces, which to quite a considerable extent are now obliged to obtain their timber from upper Norrland. On the basis of the investigations of the Forestry Research Institute future yields can be calculated and fellings planned well in advance.

It is hoped that a third production period is about to be entered upon based on research in chemical utilization. Such production would be of advantage to the home as well as the export market, since wood as raw material could be used as a substitute for goods previously imported.

During the last decade there has been an increasing movement of population from the rural districts of Norrland. The importance not only to Norrland but also to the whole of Sweden of taking measures to encourage the return of forestry and agricultural workers to the countryside is emphasized. R. P. J.

98.2 (73). SHAMES, L. M. **Lumber trade policies.** *J. For.* 43, 1945 (81–7). [Appalachian Forest Exp. Sta., Asheville, N.C.] [508].

The writer considers that free trade is desirable, though a sudden and complete break with protectionist policies might not be practicable. A gradual approach by establishing free trade in commodities which have not been much dependent on protection, would provide a first step. In the United States lumber is such a commodity. The volume of imports has been small relative to domestic production, and most of it comes from Canada. The history of lumber tariffs is reviewed and the influence of imports on the domestic industry

is shown to be negligible. Tariff barriers have reduced lumber imports and raised domestic lumber prices, but the influence exerted has been limited to a few species and to localized border regions.

98.2 (73) : 33.32. **Postwar policies for the United States wood pulp industry.** The United States Pulp Producers Association, 122 East 42nd Street, New York. 1944. pp. 8. [509].

The purpose of this statement, which presents the views of the United States Pulp Producers Association, is to outline the policies of the wood pulp industry of the United States with respect to post-war competition, and to define conditions necessary for the maintenance of the industry's position in the national economy.

FORESTRY THE WORLD OVER

References: 1. *British Columbia Lumberman*, Vancouver, B.C. 2. *Comércio de Porto*, Lisbon. 3. *Correro da Manha*, Brazil. 4. *Country Life*, London. 5. *Diario de Noticias*, Lisbon. 6. *Domestic Commerce*, Washington. 7. *El Mercurio*, Chile. 8. *Foreign Commerce Weekly*, Washington. 9. *Forest Treasures* (*J. Cyprus For. Ass.*), Nicosia. 10. *International* (*Chemical and Export*) *Industry*. 11. *Jornal do Comércio*, Lisbon. 12. *Journal of Forestry*, Washington. 13. *Neue Zürcher Zeitung*, Zürich. 14. *Økonomisk Revue*, Oslo. 15. *Paper Trade Journal*, New York. 16. *Timber and Plywood*, London. 17. *Timber of Canada*, Ottawa. 18. *Timberman*, Portland, Oregon. 19. *Timber Trades Journal*, London. 20. *West Coast Lumberman*, Seattle. The numbers in brackets indicate the reference number and the date of publication of the newspapers and journals to which the annotations refer.

Australia. The planting of large areas of Monterey Pine in southern and possibly northern states of Australia is one of the major post-war projects planned for by the pulp and paper industry there (**15**; 19.10.44).

Bahamas. Timber stands grow on four islands in the Bahamas group—Abaco, Andros, Grand Bahama, and New Providence. The only sawmill concern operating in this region recently transferred from Abaco to Grand Bahama, and there has been a gradual trend towards increased production. Only sawn timber is produced at present, but later operations may include pitprops for export to the United Kingdom (**8**; 21.4.45).

Belgian Congo. 50,000 tons of lumber is being shipped annually from Belgian Congo to the Union of South Africa, mostly heavy to light hardwoods. Limba (*Terminalia superba*), one of the lighter woods, is said to be the only African wood so far found suitable for the manufacture of aeroplane propellers (**8**; 19.5.45).

Brazil. The present shortage of lumber results directly from transport difficulties. Reserves of Pine, Pau-Marfim (*Aspidosperma* spp.), Canelas (*Licaria* spp.) and other woods in Rio Grande do Sul, Sant Catarina, and Parana are extensive. The Brazilian Government is now promoting a forestry and reforestation programme, and hardwoods are being planted on a large scale.

Although São Paulo's hardwood forests have been heavily cut in recent years, it is estimated that supplies are sufficient for a number of years, even at the present rate of cutting. The São Paulo Officer of the Brazilian National Pine Institute has announced plans to encourage the planting of Pine forests in that State. The authorities have bought the Fazenda Itangua between Capao Bonito and Itapeva, where 2,000,000 Pine seedlings will be planted for experimental purposes. The Institute is buying the necessary machinery and is studying methods for distributing and planting Pine seedlings (**8**; 21.10.44).

Distribution of 9,000,000 *Eucalyptus* seedlings in the State of São Paulo has been announced by the State Secretariat of Agriculture. In 1943 7,000,000 seedlings were distributed. The trees are intended for firewood and will be ready for cutting in 3 to 4 years (**8**; 7.10.44).

It is estimated that over the last 25 years the average forest devastation in the São Paulo State has amounted to 14,600 alqueires, corresponding to an area of 353 sq. km., without including timber cut for industrial purposes. The consumption of wood and charcoal in the same period was 25 million cu. ft., not including timber felled for agricultural purposes. The figures relative to timber indicate a volume of more than 1½ million cu. ft. a month, distributed as follows: ½ million for railways, 400,000 for industry, 300,000 for domestic purposes and 300,000 for the production of charcoal, the equivalent of 6,250 ha. a month or 75,000 ha. a year (**3**; 1.7.45).

Canada. The Winnipeg Conference Committee, representing the large majority of Canadian timber operators and manufacturers of forest products in each of the 9 provinces, has submitted to the Cabinet recommendations for a revision of the present Dominion government taxation policy as it affects the forest industries, with particular reference to forest income and allowance for exhaustion of timber limits. These recommendations are as follows:

(1) That the principle of capital gain be recognized in respect of allowances for the exhaustion of timber limits.
(2) That a special allowance for exhaustion be granted on account of uninsurable risks inherent in the forest industries.
(3) That expenses for reforestation or for securing natural regeneration and for protection of timber limits be chargeable as current operating expenses at the option of the taxpayer.
(4) That all of these revisions be made effective as of the year 1944 (**17**; March, 1945).

The Christmas-tree industry, comparatively new to the Gaspé Peninsula, Quebec, has become important in the region recently. Only Balsam Fir is cut, this species being most in demand by the trade. Cutting and marketing of Christmas trees has become a million-dollar industry in Canada. About 75 per cent. of the annual production, or 6 million trees, is exported, principally to the United States, but also to Hawaii, Bermuda, and Jamaica (**8**; 1.1.45).

Canada was responsible for the production of vast quantities of pre-fabricated 'Minca' (made in Canada) flat-bottomed, blunt-nosed, Thames-type, wooden barges, which were used as beach-landing craft, barrage balloon moorings, lighters, and stores and ammunition carriers in connexion with D-day and other Channel operations. These were constructed of lumber from the Maritime Provinces and, when they arrived in Great Britain, were assembled mostly in the Surrey Commercial Docks (**16**; 31.5.45).

The Ontario Department of Lands and Forests spends $3,000,000 annually for fire prevention and plans to increase this amount in the future. Four planes were added to the Division of Air Service in 1944 and four more will be added in 1945, which will bring the total forest protection fleet to 37. R.C.A.F. planes will assist the Ontario Government this year in spraying insecticides over a large area (**8**; 19.5.45).

Cape Verde. By 1943 some 350,000 trees of various species had been planted over an area of 500 ha. All efforts at afforestation have been hindered by lack of rain, and the problem was aggravated by wide-spread soil erosion (**5**; 10.12.44).

Chile. The forest area of Chile represents 22 per cent. of the total land surface of the country and 45 per cent. of productive area. There are 5½ million ha. of merchantable timber. The volume of timber destroyed annually by fire is estimated at 4½ times the volume of timber utilized. With proper management and protection, production might be 2½ times what it is (**7**; 7.5.44).

About 30,000 ha. in Concepcion Province, Chile, are utilized for forest plantations. More than 70 per cent. of the plantings are of *Pinus insignis* and about 20 per cent. of Eucalypts. These two species are being planted for industrial purposes. It is considered that a total of 150,000 ha. should be devoted by the Province to forest plantations (**8**; 7.10.44).

Particularly fine results have been obtained in the manufacture of plywood from Coiguë (*Nothofagus* sp.) and two related softwood species Laurelio and Laurelia (*Laurelia aromatica* Juss.). The latter are very abundant and produce a slightly cream-coloured plywood, almost white in appearance. The plant is owned by the Sociedad Agrícola y Maderera 'Neltume' Llda. at Panguipulli, and produces 6 million sq. ft. of plywood per annum. This figure will be increased when war-time restrictions are removed (**18**; March, 1945).

Cyprus. In 1942 a grant of £50,000 was made out of the Colonial Development and Welfare Fund for the establishment of fuel plantations in rural areas. Lack of fuel has been a major cause of the destruction of forests in Cyprus, and has also been a serious cause of friction between peasants and the authorities. The establishment of the plantations will not only help to solve these problems, but will add a much needed improvement to the country side. It is intended that the money available shall be spent in such a way as to demonstrate the benefits of fuel plantations in the most convincing manner: any villages willing to co-operate, and which are thought to be alive to the importance of such plantations, are to be assisted in their establishment (**9**; 10.12.44).

During the last three years very satisfactory progress has been made in planting up bare forest areas and building roads to open up the forest. In 1942 and 1943 £17,000 was spent on afforestation work. Part of this money has gone to restoring forest growth on steep mountain burns, for the treatment of which new and successful methods have been evolved. Some £5,000 has been spent on reclamation works in the Limassol marsh, where thriving *Eucalyptus* plantations have been established, in reclaiming the salt lands of the Ayios Lukas lake, and in covering the blowing sands of the Ayi Irini area with green forest growth. More than £27,000 has gone in compensation to forest shepherds in the Paphos-Troodos Forest area, where grazing has been entirely stopped, thus saving millions of young self-sown seedlings. Nearly 28 miles of new roads have been built, mostly in the Paphos and Adelphi Forests.

The forests of Cyprus have provided large quantities of timber and poles for export to the Middle East, and almost the whole of the timber required by the military for internal defence works as well as for the construction of A.R.P. shelters has been produced locally. As further large-scale fellings could not be made without causing damage to the forests, all exports have been suspended, and fellings on a much reduced scale are now permitted only for the supply of timber for the most urgent military works, for the local shipbuilding industry and for reduced domestic consumption.

A new section of the Forest Department came into being in 1943 to handle the problem of providing fuel and charcoal for the towns and large rural centres. Arrangements are being made to use oil fuel in place of wood. New apparatus and burners are being provided which will enable lime kilns and gypsum kilns as well as the simple zivania kilns to operate on cheap oils (**9**; 12.44).

Denmark. The annual increment of Danish forests, without bark, is estimated at 1,400,000 cu. m. (57 per cent. broadleaved and 43 per cent. coniferous timber). During the three-year period 1941-43 timber production in Denmark exceeded the normal cut by 1,661,000 cu. m.; Beech forests in particular were heavily over-cut, a volume equalling nearly 2½ times the increment being removed during these three years. The maximum cut for the forests as a whole during 1943-44 was placed at 2,040,000 cu. m., the same as that for the previous year (**14**; 19.12.44).

Ecuador. Commercial timber developments in Ecuador include: (1) the production of Balsa which is centered about Guayaquil in the coastal region and has been greatly expanded during the war; (2) the cultivation of Eucalypts in the Sierra to serve essential needs for constructional timber and firewood; and (3) the logging of hardwoods for cabinet making—these are extracted both in the coastal region and the Oriente. Lack of transportation is a serious obstacle to forestry operations in Ecuador. Another unfavourable factor is the absence, in general, of pure stands of the useful species. Economical exploitation would require the cutting of all species and the establishment of sorting and grading facilities (**8**; 5.5.45).

Egypt. Of great importance in the successful establishment of orange gardens in Egypt is an ample provision of shelterbelts to protect the fruit trees from dry desert winds, the belts being laid out to form compartments of appropriate size according to the incidence of the prevailing wind. For this purpose the quick-growing *Casuarina equisetifolia*, so-called She-Oak, is largely employed. A further protection is the provision of an outer broad belt of Prickly Pear (*Opuntia*). The fruits of the Prickly Pear are much esteemed by the Egyptian people and the yield from these belts has a sales value of something like £30 an acre (**4**; 23.3.45).

Great Britain. At the end of the last war, five apprentices' schools were established by the Forestry Commission; later the instructional work was concentrated in the Forest of Dean and at Benmore. During the 20 years 1919-39, 427 apprentices received their qualifying certificates, of whom 378 were appointed to the Commission's service. The first educational duty of the Forest

Authority in the post-war period will be to select and train a large number of forest foremen. The number of trained foresters before the war, in national forests and estate woodlands combined, did not exceed 1,000, and the Forestry Societies have suggested a figure of 2,000 men for post-war training (4; 26.1.45).

Mexico. A chart of forest resources for the entire country has been completed, with special charts covering the forest resources in the States of Hidalgo, Puebla, Queretaro and Tlaxcala. Also a new forest law has been prepared, aimed at rational use of these resources: one of the provisions prohibits the felling of trees on slopes greater than 15 per cent. Two permanent forestry experiment stations are planned; one, in the northern part of the country, is to undertake research on temperate zone forest products; the other, in the south-west, will work on tropical woods.

At the port of Tampico a start has been made in the fixation of sand dunes which are menacing the oil refinery and railway station there. Similar projects are planned for the ports of Veracruz, Coatzocoalcos (Puerto Mexico), and Santa Cruz.

Causes of forest fires have been investigated, and a number of observation towers have been built; patrols protect the forests during the dry season (**12**; February, 1945).

Netherlands East Indies. Information reaching the Netherlands authorities indicates that the Japanese have been maintaining the Cinchona plantations and quinine-producing equipment in the Netherlands East Indies. The Cinchona trees mature in cycles and no acute shortage can occur for about 15 years, by which time the trees that should have been planted during the past 3 years would normally have been ready for harvesting. In order to preserve continuity, the Dutch left one out of every 6 quinine factories intact, and left in the occupied Indies 120 experts in Cinchona cultivation (8; 12.5.45).

Peru. Demand for tree planting stock is increasing in Peru. More than 2,500,000 seedlings were distributed by 21 nurseries in 1943. Imported seeds of various species have been planted in the nurseries and special experimental work is being done on acclimatization. Certain zones are being reforested as a national defence measure, and reforestation is being used in the Sierra as a protection for towns and communication lines threatened by torrents. A campaign has been organized for the formation of model forests in some regions. Reforestation of the lomas is being continued in Lachay, Matarani, and other districts (8; 28.10.44).

Poland. The Polish Committee of National Liberation on December 21, 1944, took over all privately-owned forests of more than 25 ha., totalling 5 million ha., to which must be added 1 million ha. of privately-owned forests of less than 25 ha. Annual increment under present conditions, as a result of German devastation, is about 2 cu. m. per ha., or a total increment of about 12 million cu. m. Average annual consumption of wood for fuel is about 1 cu. m. per capita of the population, and 9 million cu. m. were consumed annually for this purpose before the war. Poland before the war exported 1,700,000 tons of wood and wood products per annum (18 per cent. of the total exports) and used 11 million cu. m. annually for building, industry, and wood processing. Wood will now have to be imported (Radio Polski, Lublin. 14.2.45).

Portugal. Exports of cork have increased enormously during the war. By September, 1944, 80,603 tons had been exported; the September exports amounted to 13,149 tons. New wages for the cork industry, representing an increase of about 30 per cent., have been fixed by the Under-Secretary for Corporations (**11**; 23.11.44).

Three decrees, designed to control afforestation and timber production, give the Government wide powers for the control of felling and disposal of timber on private estates, together with powers of requisition, and formulate a policy of reforestation to safeguard the timber resources of the country, particularly in regard to *Eucalyptus* and Pine. For this purpose a forestry development fund is to be set up (**5**; 2.2.45).

Portuguese Guinea. Portuguese Guinea supplies only about 1,000 cu. m. of timber annually to Portugal. There is plenty of high quality timber in the country, but a lack of expert workmen and of equipment. A properly equipped forestry department is needed to create an efficient timber industry (**2**; 12.2.45).

Spain. Galicia is the second most heavily forested region in Spain, the first being the Cantabrican area. Several million Pine seedlings have been planted in Galicia since 1928 and, in view of

the benefits already apparent, a programme involving the reforestation of about 12,000 acres per province annually has been suggested by the Agricultural Congress of Galicia. It is also proposed that scientific timber cutting be adopted and that cut-over areas be replanted by the owners (8; 27.1.45).

Sweden. In a recent Bill presented to the Riksdag, the Swedish Government proposes certain price-adjustment charges on exports, primarily timber products for a transitional period of one year. The object is to prevent domestic prices from soaring as a result of heavy demand from abroad. The funds collected will be used for the improvement of forest roads, increased research, and similar purposes. It is expected that it will be possible to limit the price-adjustment charges to wood products only (**19**; May, 1945).

Stocks of wood pulp in Sweden are reported to amount at present to about 700,000 tons, which means that the warehouses are filled to capacity. In 1939 wood pulp accounted for 18·3 per cent. of the value of Swedish exports, and 40 per cent. of this was shipped to the United States. Sweden has contracted to supply Great Britain with monthly shipments over a year amounting to 20,000 tons a month. Swedish production of wood pulp for sale is said to total nearly 250,000 tons a month (8; 4.11.44).

Switzerland. A motion for State aid to forestry after the war has been made in the Swiss parliament. It is pointed out that as a result of the necessary increased exploitation during the 5 years of war, the productive capacity of the Swiss forests has been considerably reduced. The aim is now to make a thorough revision of forest law and to develop sound legislation as a basis for forest management (**13**; 20.12.44).

Switzerland's timber requirements are now about 4,000,000 cu. m. annually. Of this total, 3,000,000 cu. m. can be produced from home forests, and this amount could be increased by about 800,000 cu. m. annually by the construction of a large number of forest roads, the building of which has been suggested as part of a future programme to provide employment. It is considered that at least 100,000 ha. should be afforested to compensate for the heavy felling of the war years. Draining of swampy forests, and the protection of standing timber from avalanches and landslides are other measures suggested (8; 27.1.45).

United States. Official data, released for the first time, disclose the extent of the U.S. veneer and plywood industry. A total of 610 establishments are engaged in the production of veneer or plywood or both. Manufacturers of plywood number 250; their equipment capacity surpasses 5 billion sq. ft. annually. The hardwood industry is the larger and more widespread. Production of hardwood veneer is carried on in nearly all States, and more than a dozen species of timber are utilized, with Sweet Gum (*Liquidambar styraciflua*), Black Gum (*Nyssa aquatica*), Maple, Birch, Mahogany and Yellow Poplar among the leaders. The softwood industry is concentrated in the Pacific north-west region and is largely based on a single species, Douglas Fir (**6**; November, 1944).

Increased production of exterior-type or waterproof Douglas Fir plywood in 1944 set a new record of 350 million sq. ft., an increase of 15 per cent. over the previous year. All mills in the Douglas Fir plywood industry are now equipped with the necessary hot-press installations, and it is expected that the volume of this type of plywood will at least be matched in 1945, especially since phenolic resins will probably be in more ample supply (**6**; January, 1945).

A new factory has been established in the heart of the Georgia Pine belt for the manufacture of pre-fabricated houses for the United Kingdom and France. Contracts have already been placed for 500 houses for Britain and barrack structures for France (**1**; April, 1945).

The 15 or so national associations of timber manufacturers have recently issued a programme of post-war planning. It includes the building and opening of an industry-owned research laboratory now being completed and equipped to engage in physical and chemical research in wood utilization; the employment of a Research Co-ordinator to co-ordinate wood research between industry, public agencies and universities engaged in such research; the establishment of 'American Tree Farms', a system of private forestry and forest growing initiated and administered in co-operation with other forest industries; the development, in co-operation with public agencies, of a wood-sugar industry as an aid to more complete wood utilization (**6**; November, 1944).

Experiments carried out by the Chapman Manufacturing Co., Corvallis, Oregon, with waste wood

as a base for some sort of plastic case for refrigerators, have resulted in an array of plastic products, all of which contain from 80 to 85 per cent. waste wood, and finally to a material which will not burn and requires 600 degrees to char, has a tensile strength of about 30,000 lb., high impact strength, and only a trifling width increase after 24 hours immersion in water. It is capable of press moulding into shape and after moulding will neither warp, split, not exhibit any pitch. It takes any colour without loss of gloss. The wood fibre, when treated, will not be subject to either rot or decay, but has a higher thermal resistance than either rock or steel wool.

The process of reducing the wood is purely mechanical, with a 98 per cent. recovery, including all lignin in the slab wood after the bark has been removed. After defibration the wood is mixed with certain resins, pigment is incorporated, and it is then preformed on a screen. When the screen has picked up sufficient depth of the water-soaked pulp, 90 per cent. of the water is squeezed from the preform, and the remainder evaporates in the press. The material emerges from the press with a smooth finish (**20**; February, 1945).

U.S.S.R. By the end of September, 1944, three-quarters of the timber cut for the current season in the Soviet Union had been floated to its destination, according to the Russian press. For the first time since the war, timber was floated down many of the rivers in the Ukraine and White Russia. The Kerch logging boom, one of the largest, was the first to complete its schedule. About one million cu. m. of timber were rafted down the Kama River. From the upper Kama, 29 large caravans of rafts were sent down the Volga to Stalingrad, Saratov, Kuibyshev and Astrakhan; 7 of these caravans arrived in Stalingrad late in September after a journey of 2,000 km. (8; 3.2.45).

Forest areas in the Soviet Union that were burned or cut down during the war are being restored under a large-scale replanting programme. Thousands of hectares are being planted in liberated areas in Central Russia, particularly near large cities and along railways. About 10,000 ha. are expected to be reforested in the Orel, Voronezh, Tula and other districts during 1945 (8; 11.11.44).

A five-year plan for the restoration of Soviet forests has just been compiled. According to incomplete reports, the damage caused by the Germans to Soviet forests exceeds 3,000 million roubles. To ensure themselves against sudden attacks from partisans, the Germans cut down all trees along roads and highways to a depth of about 500 m. on either side of the roads. Large forests in which partisans were thought to be hiding have been almost completely burned.

Thousands of hectares of newly planted forest have also been destroyed. In the Rostov and Stalingrad regions between the Volga and the Don 900,000 ha. of forests have been completely destroyed, in addition to 1,500 ha. of tree nurseries. (**10**; January, 1944).